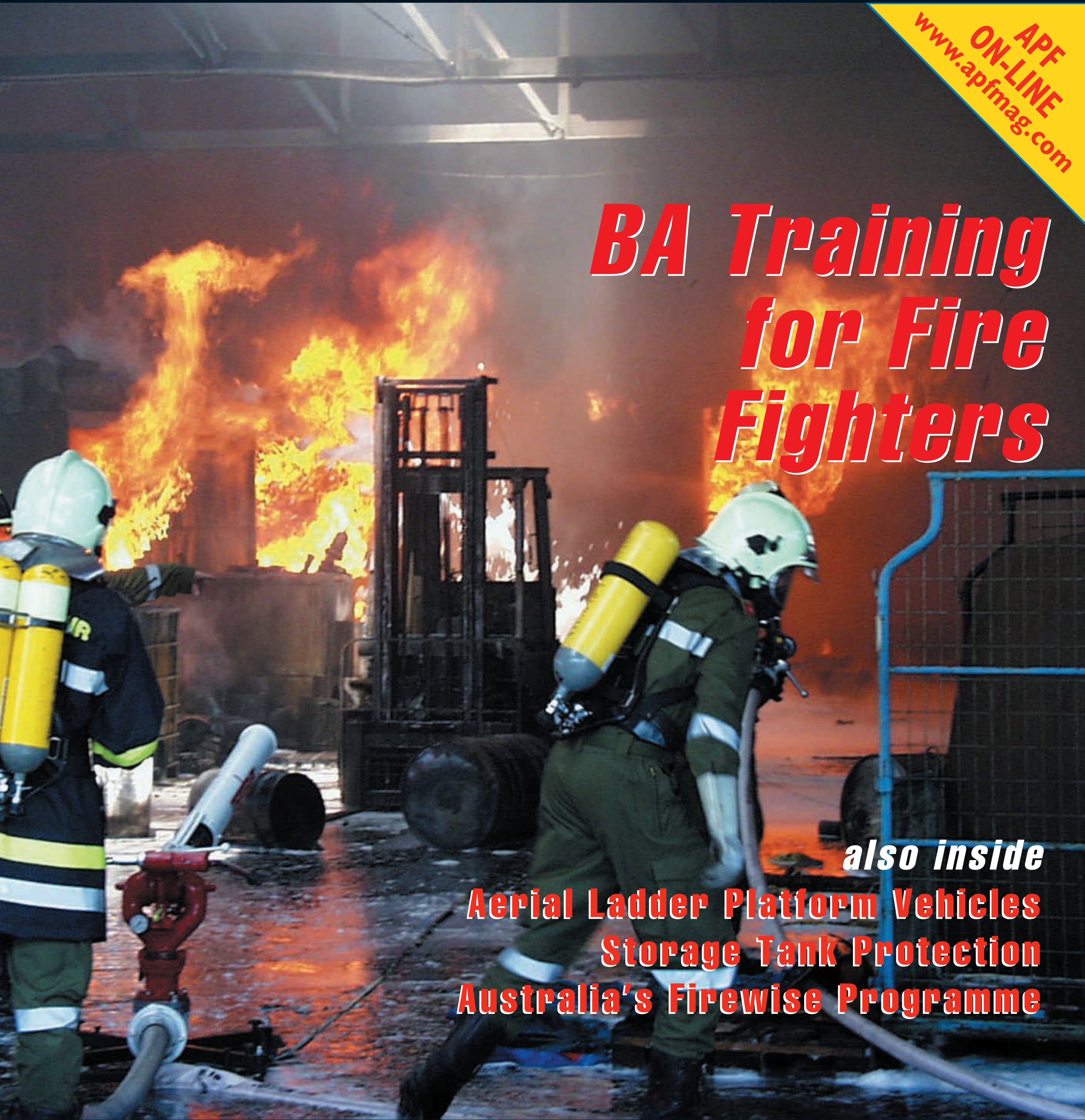
An MDM PUBLICATION
Issue 5 – March 2003

APF

ASIA PACIFIC FIRE MAGAZINE



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REPORTING TO THE ASIA PACIFIC FIRE PROTECTION AND FIRE SERVICE INDUSTRY

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APF is published quarterly by:
MDM Publishing Ltd
18a, St James Street,
South Petherton, Somerset TA13 5BW
United Kingdom
Tel: +44 (0) 1460 249199
Fax: +44 (0) 1460 249292
e-mail: apfmag@globalnet.co.uk
website: www.apfmag.com

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Periodical Postage paid at Charnplain New York and additional offices
POSTMASTER: Send address changes to
IMS of New York, P 0 Box 1518
Champlain NY 12919-1518
USAUSPS No. (To be confirmed)

Subscription Rates
Sterling – £35.00 AUS Dollars – $100.00
US Dollars – $55.00
(Prices include Postage and Packing)
ISSN – 1476-1386

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Page design by Dorchester Typesetting Group Ltd
Printed by The Friary Press Ltd

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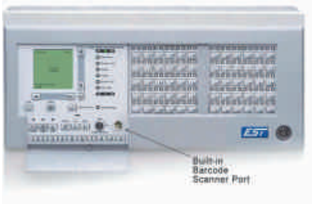

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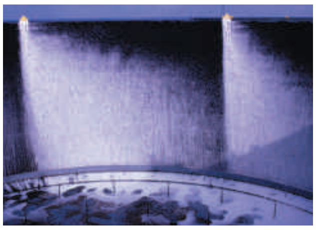

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AN APOLOGY

In the last issue of APF magazine, we ran an article written by Mr. Mark Gribble entitled "The last line of defence". We would like to make it clear that Mr. Gribble in no way promotes any single fire fighter clothing manufacturer or its products and is completely neutral in all of his duties as Senior VP and National OH&S Coordinator for the United Firefighters Union of Australia, Queensland Branch and as a Member of the Emergency Services Advisory Council. The choices of photographs used in Mr Gribble's article were ours and were not supplied by the author. We would like to apologise to Mr. Gribble and to our readers for any misrepresentation our choice of photographs may have caused.

Mark Seton
Publisher

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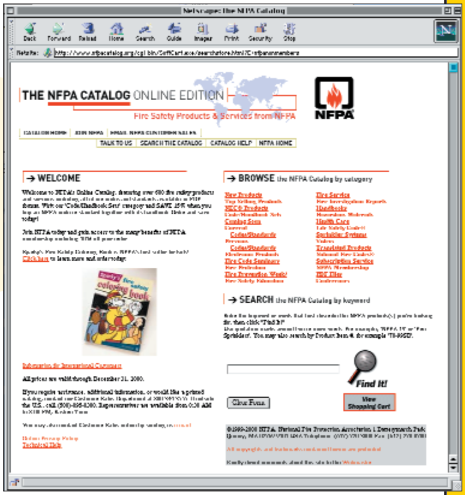
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FOREWORD

by Jeff Godfredson

NFPA's Asia-Pacific Operations Director

THE PAST FEW MONTHS have been filled with disastrous fire in the region. The have been a number of incidents of tragic loss of life: the largest was 33 killed in a restaurant fire in Harbin, China during Lunar New Year celebrations. There were also many deaths as a result of fire involving fireworks. It was also sad to see the loss of a priceless palace to fire, also in China.

It is interesting to observe the response to these events, primarily charging the owners with various offences. I believe it would be more productive for all concerned to prevent such incidents and to ensure that systems are in place to minimize the impact. I believe this to be a self-evident truth.

In most of the recent events, the same issues of lack of exits, locked or blocked escape routes, lack of training and insufficient means of fighting a fire, were reported. Why is it that history keeps repeating itself? When I ask this question, I am told a number of reasons: "As a developing country, we cannot afford expensive fire protection systems." The second most quoted reason is corruption. In my opinion any official who turns a blind eye to flagrant breaches of life safety is committing a far greater offence than the building owner because they are fully aware of the potential consequences of their actions.

In most of the tragic events, if all the existing exits had been clearly indicated and clear, the number of deaths would have been reduced. Such action does not require expenditure, it require education and a desire to preserve public safety. Codes such as NFPA 101 (Life Safety Code) clearly spell out what is required for safe egress from a building. NFPA 1 (Fire Prevention Code) advises on requirements to prevent and minimize the impact of fires. Using such codes for guidance would be a step in the right direction. An innovative approach would be to make sure the building owners "self inspect" to guidelines provided by the authorities. It is better to hold the building owners/occupiers to account before the event than after.

I am not suggesting that tackling these problems is easy but there is a need to be proactive NOW or we will continue to see unnecessary loss and suffering.

Jeff Godfredson
NFPA's Asia-Pacific Operations Director

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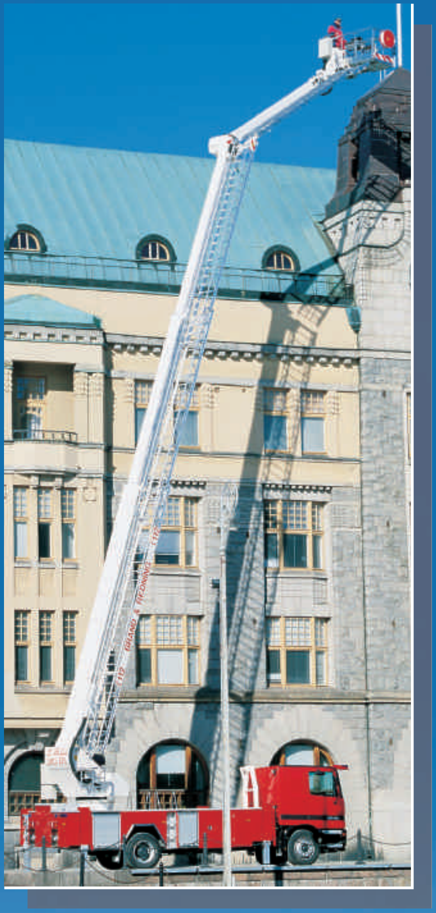

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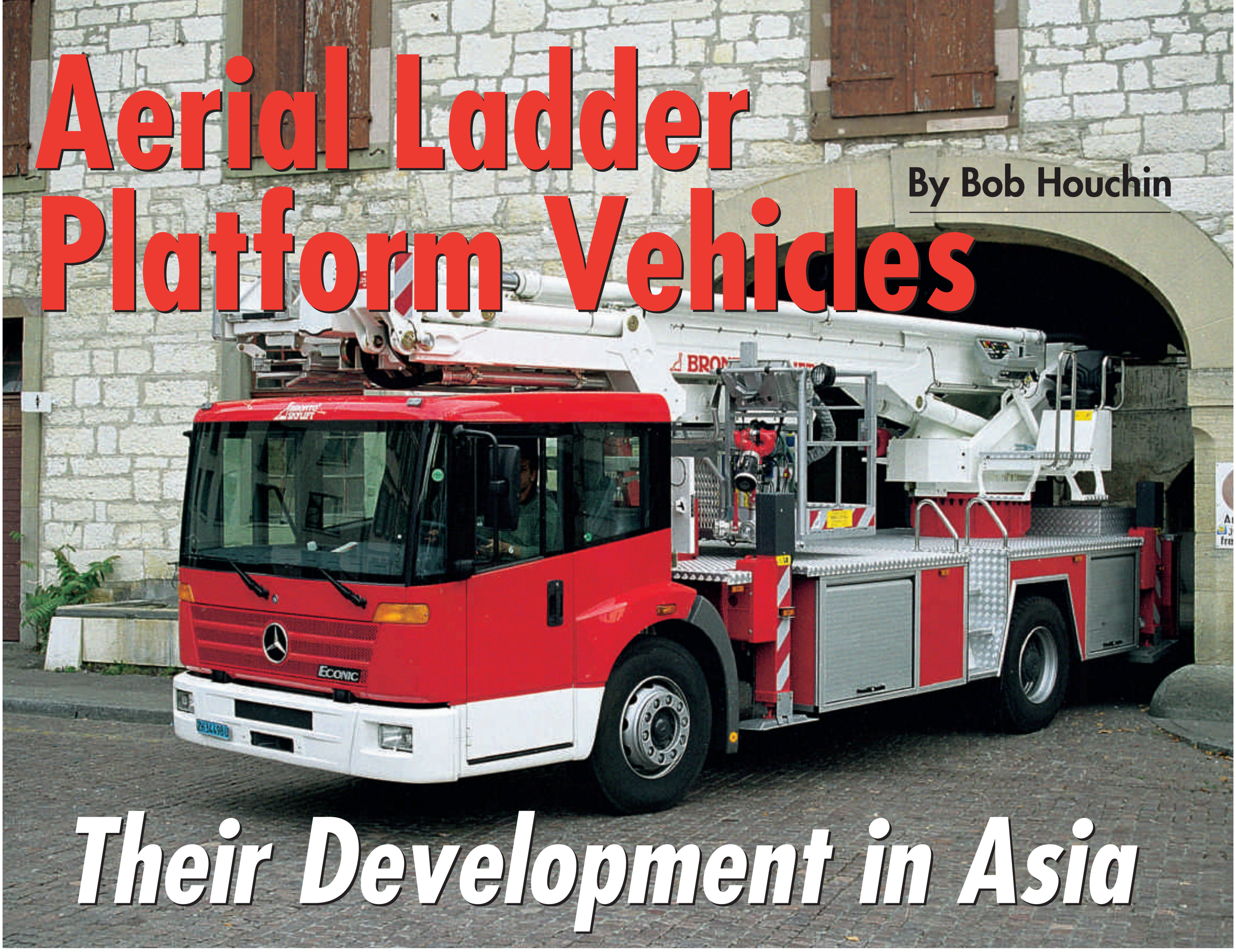
Aerial Ladder Platform Vehicles

Their Development in Asia

By Bob Houchin



Pic courtesy of Bronto Skylift

CPL or ALP, call it what you will but it is a combination of a turntable ladder and an aerial platform or Snorkel as they were fondly known.

The principal manufacturers of these devises are Bronto Skylift and Vema from Finland as well as Magirus from Germany. Other smaller players are in the market, but they have little or no customers in Asia. Furthermore, there are now copy products being produced in China, which will eventually hit at least the main land China market.

First seen in a similar guise from Comet in Belgium, the concept was really developed and marketed initially by Bronto, who sold the first unit to Savonlinna, in Finland in 1985. Although started by Bronto in the mid 80's, the next to start a similar line were Simon Engineering in UK, who saw that Bronto were onto a good thing. They developed the ST range to compete with Bronto, taking their first order in 1987 and finally delivering the unit in 1990 to a regional UK brigade.

However the product had many problems, and was redesigned and "reissued" in 1993 as the ALP340.

Pic courtesy of Vema Lift Oy

Subsequently with the demise of the Simon Engineering facility, the design was sold to Magirus, who now produce the product in Germany, with a totally revised design and control system and now market them under the ALP range, which covers from 27 m up to 54 m.

Aerial Ladder Platform Vehicles

Magirus	*Working Height*	*Outreach*	*Payload*	*Operating Weight*
ALP320L	32	20	325	18000
ALP340	34	23	400	26000
ALP420	42	20.5	400	33000
ALP540	54	21.5	400	40000
Vema				
273TFL	27	17	400	17000
323TFL	32	18	400	18000
333TFL	33	23.5	400	25000
383TFL	38	19	400	22000
443TFL	45	24	400	32000
Bronto Skylift				
F23RL	23	13.7	270	12000
F27RLH	27	21	400	16000
F32RL	32	20.5	325	16000
F37RL	37	18.5	325	18000
F42RL	42	21.8	400	26000
F53RL	53	25	400	32000

Although accurate figures are not available from Magirus, it is believed that since the re-launch of the product, units have only been sold to China and Taiwan.

Vema entered the field in 1990, with a product to primarily compete with Bronto. Data available seems to indicate that they have sold a total of 17 units in Asia.

From currently available figures, Bronto have over 200 units operating in Asia.

COMPARISON

All three manufacturers produce a range offering working heights from 23 metres up to 55 metres.

A basic comparison of the available models is given in the table above.

The initial products were heavy in construction, and needed a big chassis to carry the bulk, but Bronto introduced the MDT (now the RL range) in 1996, which was a lighter weight version, and could be mounted on smaller chassis' whilst achieving the same resultant operating range.

The use of the ALP in Asia is growing. The ladder is slowly replaced by the ALP as the platform becomes more useful than the ladder in most cases. An example is shown here, that could not be tackled by a TTL. This can be seen in as much that both Singapore and Hong Kong have replaced 53 m TTL's with ALP's.

It becomes apparent that the actual ladder section is rarely used, and so far to my knowledge the use of the ladder poses the same problem as the TTL, ie, how to get people to use it.

WHAT ARE THE REAL ADVANTAGES?

In order to make some basic comparisons, I have again made a table, below, which will clearly show the advantages of the ALP against the TTL at 53 metres.

Topic	**ALP**	**TTL**
Cost	75% of TTL	100%
Operating weight	30000	24000
Length	12 metres	12 metres
Outreach	25 metres	17 metres
Payload	400 kg	180 kg
Time to rescue a family of 5 from a flat	270 secs (1 platform load)	584 secs (5 lift loads)
Up and over facility	Yes	No
Laser range finding	Yes (Bronto Skylift only)	No
Cage protection	Yes	No
Collision guard	Yes	No
Permanent water way	Yes	No
Water flow	4000 lpm	2000 lpm
BA facility	Yes	No
Power outlet	Yes	No
Stretcher support	Yes	Yes
Can be used as observation tower	Yes	Maybe

OTHER OPERATIONAL ADVANTAGES ARE...

Continuous rescue capability, by use of the boom ladders for high-density evacuation emergencies. The boom ladders are wide with high handrails and rigid thus offering maximum confidence to those using them. A large platform for rescuing the elderly, infirm and children or anybody too frightened or injured to go down a ladder.

The cage also provides the fire fighter with a stable platform from which to fight all types of fires. With a water monitor capacity of up to 4000 litres per minute, the appliance is also ideally suited as a water tower, especially as the monitor can be operated by remote control from both the cage and the turntable or even from the ground by use of a remote control.

The outreach can be increased by utilisation of a cage payload system, which permits an additional 2–3 m of outreach with a 180 kg cage capacity. This additional capability can be the difference between life and death for, the quick snatch of one or two persons from a window, balcony, or roof of a badly burning building.

A long tip boom provides valuable additional rescue and fire-fighting capability including reaching positions behind obstacles e.g. parapets, far sides of roofs etc.

The boom design permits the cage to

Pic courtesy of Iveco Magirus GmbH

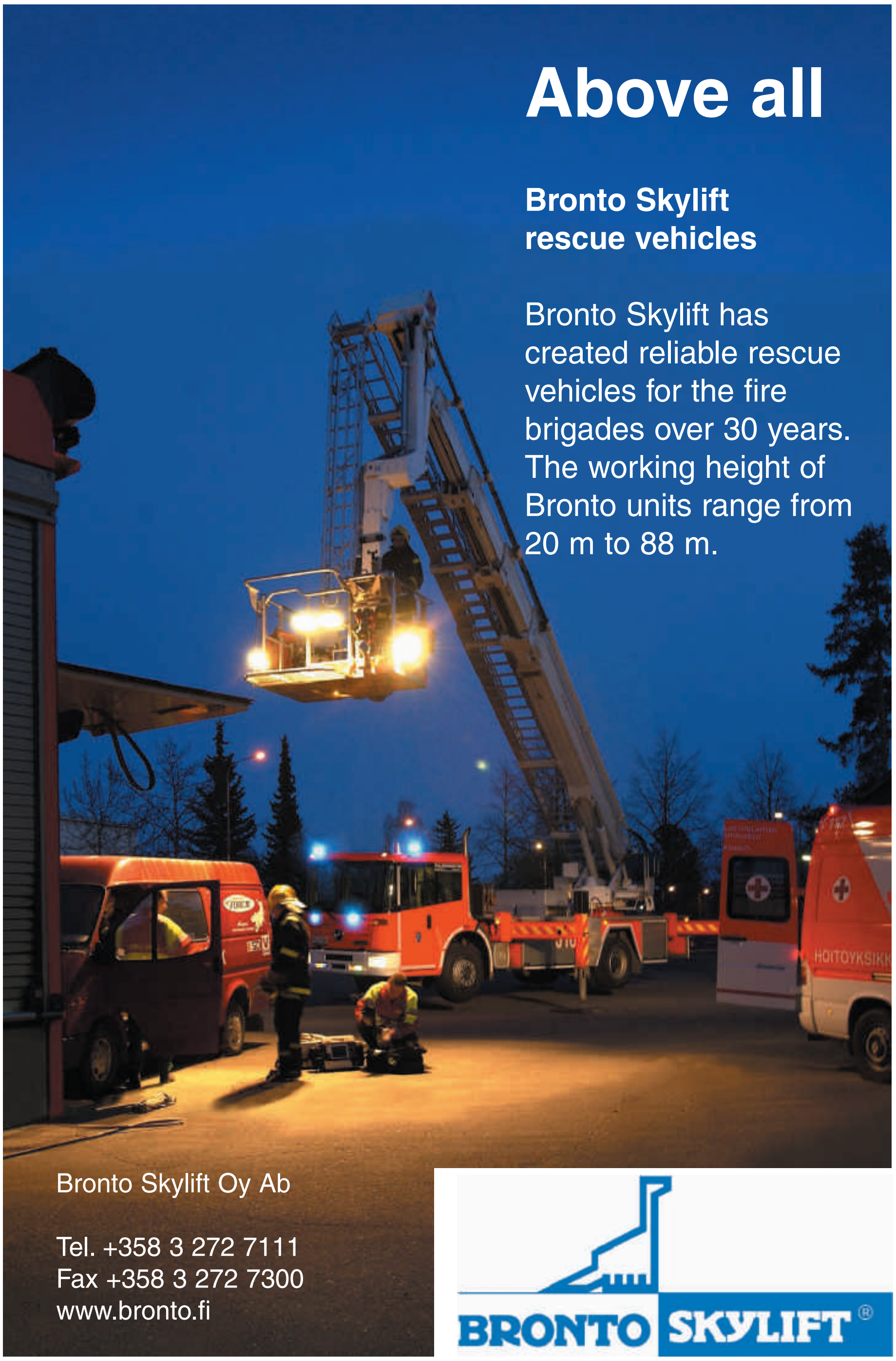
be positioned up to 5 m below ground level at an outreach of up to 18 m: This provides additional flexibility for rescues from rivers, embankments, canals, docksides etc.

TRAINING

One of the big advantages that the ALP has over the TTL is the training. Most operators find that "learning" the ALP is easier than the ladder, and of course rescue training is more practical.

Fire Services are surprised at the ease with which their training departments are able to both "convert" existing Turntable

Pic courtesy of Bronto Skylift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Ladder operators and Hydraulic Platform operators to the ALP concept and to train new aerial operators in the use of this type of equipment.

Training officers normally feel that the design of the equipment and the simplicity of the control systems are particularly “user friendly” and more importantly that the built-in safety systems and interlocks prevented damage and possible accidents in the early days of gaining operational experience.

Furthermore, Bronto have developed a Simulator training system that allows for the operators to get the feel of the controls in the classroom, before venturing out to the machine. This system allows the instructor much more flexibility in training.

Pic courtesy of Vema Lift Oy

FUTURE AND TRENDS

New developments in the market are bringing in the Octopus from Magirus, which is a revolutionary design, but not incorporating any ladder structure, and the Bronto Skylift Allrounder, which is being supplied in large numbers to Athens for the Olympics. The Allrounder forms part of a Rosenbauer concept.

> In the next few years, I think we will see the demise of the TTL at the higher level, but they still can work well at the level up to 37m, and serve a different purpose at this height. But for work above this height, the ALP is in a world of its own, and will continue to dominate the needs of high-level rescue in Asia.

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BA Training for

Backdraught/Window Unit

By Alistair Hornsby – Fire Service College

BA Training at the Fire Service College

The Fire Service College, based at Moreton in Marsh, Gloucestershire, England, offers a wide variety of fire-related courses. BA training forms a major part of these courses, in particular BA Instructor, Hazardous Material and Environmental Protection and Fire Behaviour Training Instructor. In the past few years a large number of students from the Asia and Pacific areas have attended the College for such courses. In addition, College instructors have visited countries to provide on-site advice on how similar courses can be prepared, accredited and managed at local training centres.

The facilities available at the College are second to none within the United Kingdom and can provide realistic training scenarios for a wide variety of incidents: air, sea, rail, road, high rise, off-shore, commercial, domestic, industrial, domestic, environmental . . . to name just a few. College personnel are drawn from Fire Brigades throughout the United Kingdom and bring to the College a wealth of experience and knowledge. The learning environment fostered by the College ensures that these personnel are able to develop their chosen areas of expertise through study and research. A number of areas relating to the development of BA training are currently being investigated. For the purpose of this article these developments will be tied into the Fire Behaviour Training Instructors course.

FIRE BEHAVIOUR TRAINING INSTRUCTORS COURSE

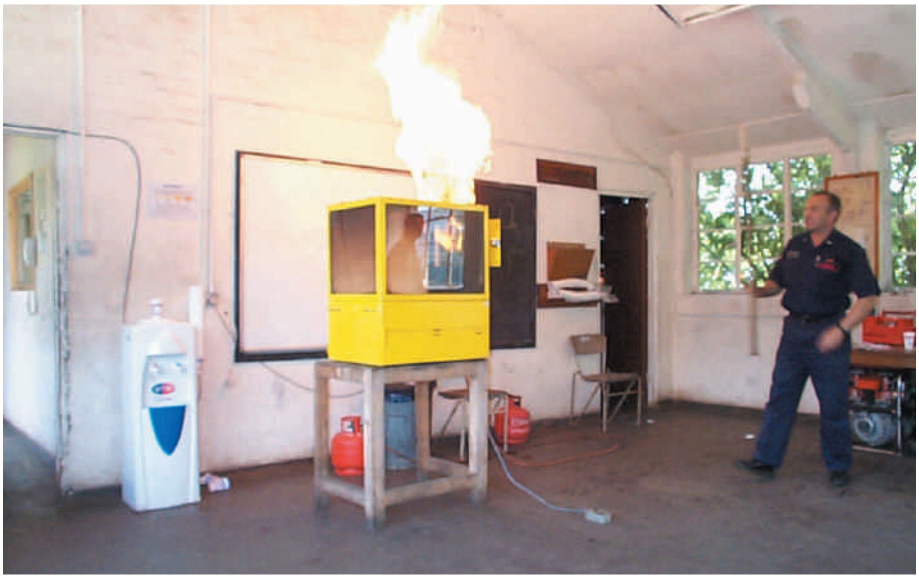
The Fire Behaviour Training Instructor course lasts for two weeks and was developed five years ago, drawing upon experience and expertise from throughout the world. The course is designed to ensure that a balance is struck between theoretical and practical knowledge. In particular emphasis is placed upon the 'instructor' element of the course. To this end the trainee instructors are required to acquire a high degree of technical knowledge which they can combine with the experience and competence gained in the realistic conditions achieved on the course. Time is spent in the excellently equipped chemistry laboratories studying the science of combustion, pyrolysis, limits of flammability, flashover, backdraughts and fire-gas explosions. As much use as possible is made of small-scale demonstrations. Equipment used includes 'Aquariums', 'Bang Boxes' and 'Wendy Houses'. Students are required to present a number of lectures on Fire Behaviour thereby demonstrating their grasp and understanding of the theory and their ability to successfully use the laboratory equipment.

Another area of the course that has been developed is the use of 'case studies'. There is concern throughout the UK Fire Service that Fire Behaviour Training is not being effectively applied to actual operational incidents. The College library holds hundreds of reports on fire incidents, which have occurred in the UK and the rest of the world. College instructors and students can use these reports and the photographs that they contain to try to ascertain the likely fire development, it's ultimate effects and any relevant learning points that can be gleaned for future use. By this method the classroom and practical based learning can be compared to and reinforced by such

FBT student in BA

Fire-fighters

studies. Students, acting within syndicates, are required to make a formal presentation based on a 'case study', which they have selected, so that any learning points can be highlighted. Part of the course requires students to submit a two thousand five hundred word assignment on any topic concerning fire behaviour. Individuals can select a case study of an incident, which has occurred within their Brigade, for this assignment.



Aquarium backdraught demonstrator

HEALTH AND SAFETY

In recent years more emphasis is being placed upon the command and control of BA at operational incidents. This is mainly due to injuries caused to operational personnel at incidents where the control of BA wearers has been found to be inadequate. The United Kingdom Technical Bulletin 1/97 on BA Command and Control provides guidance on the above. Training at the College emphasises, to student incident commanders and team leaders, the importance of proper command and control and the need for the correct command structure to be implemented at the earliest stages of any incident involving the use of BA. Another tool available to the Incident Commander is Dynamic Risk Assessment. The use of a simple flow-chart can help the Incident Commander to continuously determine the potential risks and benefits of their actions and so develop a suitable course of action and the necessary safety measures required to implement it.

It is possible that some deaths at fire related operational incidents have been due to a lack of understanding and the inability to recognise the symptoms of fire development. Understanding the risks imposed by fires and the possible consequences helps the Incident Commander to assess the safety control measures required. For this reason Fire Behaviour sessions have been developed for inclusion in a number of courses undertaken by the College. These sessions are of particular relevance on the core development courses such as Crew and Watch Commander and Junior Officer Advancement.

An area of increasing concern within the British Fire Service, particularly in Fire Behaviour Training is the health monitoring of instructors and students. Recently there has been a lot of medical research into the short and long term health hazards of repeated exposures to high temperatures. The guidance that such research has produced suggests that prior to BA training of any type, students and instructors should be fit, sufficiently hydrated, adequately rested between training sessions, free from any illness and not taking unsuitable medication. Fire Behaviour Training instructors should also complete weekly and monthly health surveillance logs. These provide Health Advisors with a clear indication of the type and duration of any 'hot' BA wears and give early warning of any unusual health problems that the instructor may be developing.

PPE

In recent years there has been a dramatic change in the Personal Protective Equipment available to fire fighters. The thermal protection afforded from fire tunics and leggings, flash-hoods and gloves has increased. Using temperature probes within the Fire Behaviour Training units, it is not uncommon to record temperatures of approximately 700, 500 and 250 degrees centigrade at head, chest and waist height respectively. Less than a decade ago it would have been unimaginable for fire fighters to endure such conditions for more than a few seconds without suffering extreme discomfort or burns. With modern PPE the level of protection afforded means that such temperatures can be endured for several minutes at a time without immediate stress. One

> *Prior to BA training of any type, students and instructors should be fit, sufficiently hydrated, adequately rested between training sessions, free from any illness and not taking unsuitable medication.*

Pakistan students/foam blanket

drawback of such superior protection is that fire fighters may become more isolated from their surrounding conditions. They can therefore, due to greater exposure, be at more risk of injury, should conditions rapidly deteriorate. This is especially relevant operationally where fire fighters can be lulled into a false sense of security. College instructors therefore try to ensure that a correct balance is struck between exposure to realistic fire conditions and the risk of injury, however minor. The old adage of 'burn to learn' should definitely be a thing of the past. It is important that students learn, through theory and practical experience, to recognise the likely outcome of fire development and learn to use their senses such as sight, sound and temperature to help gauge this development and therefore act accordingly.

Another drawback of greater thermal protection is the risk of self-induced heat stress when working hard particularly within a BA environment. Most British Brigades only issue one type of fire kit, which must be used for all types of incident. For the majority of these incidents high thermal protection is not required. Breathable fabrics can alleviate the problem of heat stress however, these can be quickly over-run if the individual is working hard or the fire kit is dirty. As mentioned above, heat stress can lead to a variety of short and long term health problems and should be avoided where possible. The College is assisting in the evaluation of various pieces of PPE and is also attempting to ascertain what is the optimum level of PPE to be worn by Fire Behaviour Training Instructors to prevent health problems. Areas under investigation include: the number of layers of clothing being worn under PPE and the use of hoods on fire tunics to protect the head.

FIRE BEHAVIOUR TRAINING UNITS

The College possesses six Fire Behaviour Training units including two flashover demonstrators, two 'attack' units and two 'window' backdraught units. All the units use carbonaceous fuel in the form of chipboard. The units have been converted locally using standard shipping containers as the base. It is felt at the College that only carbonaceous units can provide the real characteristics of fire development and behaviour. Gas training units have the advantage of being environmentally friendly and able to cope with a large through put of students but do not provide the necessary realistic conditions. They are better used for practising water application techniques once students have had ample opportunity to observe fire behaviour and practice suppression techniques within the more realistic environment of a carbonaceous unit.

There are health concerns with the type of carbonaceous fuels being used

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Inside FBT attack unit

inside containers. Chipboard normally consists of wood particles contained within a plastic matrix. The combination of wood and plastic provide a good mixture of fire gases and thick smoke with which to demonstrate fire development features such as the 'neutral plane', fire gas balloons, roll-overs etc. Unfortunately, the downside of using any plastic is the potentially adverse health effects that the products of combustion can cause. Following a report, produced by a UK Fire Brigade, highlighting these concerns the College has decided to monitor the situation. Some Brigades within the UK already prohibit the use of chipboard and will only allow untreated timber to be used. Others have adopted a variety of safety measures to reduce the risks posed.

PROGRESSING FROM SINGLE CONTAINERS

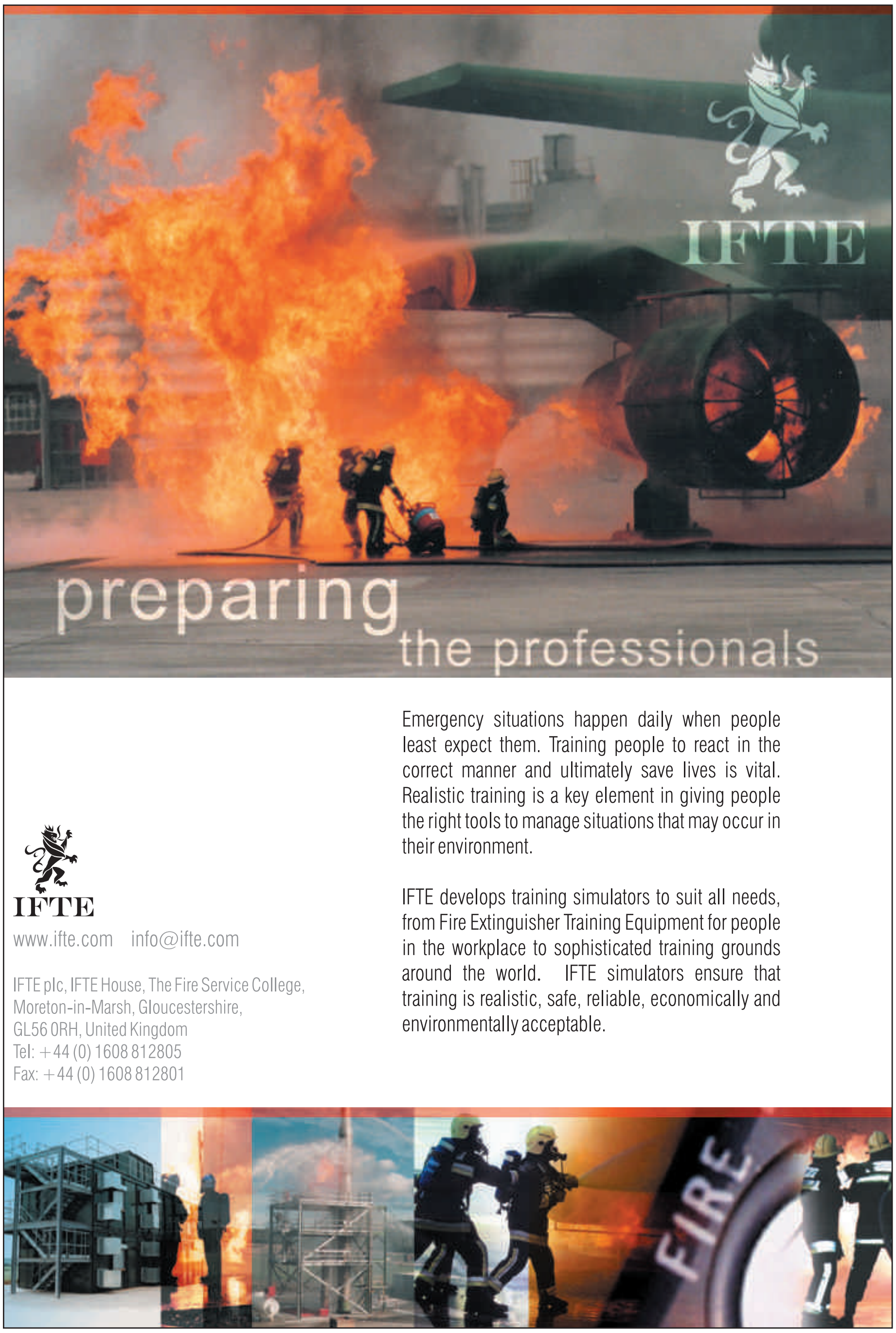
Within the UK there is growing concern that the development of FBT is stagnating and not moving forward from single container units. Several Brigades have designed and developed multi-compartment fire training facilities using containers. These give them the opportunity to reproduce and simulate a variety of scenarios for a low initial set up cost. The College already has a number of concrete structures, designed primarily for small carbonaceous crib fires, which could be adapted to provide realistic fire behaviour training. They have been used for such in the past, but high fire loading and the method of setting the fire was causing unacceptable damage. College FBT instructors are now investigating methods of building fires to give the right level of realism within these buildings without such damage.

TACTICAL VENTILATION

The College has a strong background in tactical ventilation. At present it runs a one-week course for Tactical Ventilation Instructors. Most courses such as FBTI and core progression also receive at least a half-day input on tactical ventilation demonstrating the principles and practical application of Positive Pressure Ventilation. The College is looking to develop the integration of fire behaviour and tactical ventilation within a suitably realistic training environment.

BRANCH DESIGN

There is an on-going debate, between various fire departments, on the most suitable design for a general-purpose fire-fighting branch. At the Fire Service



Emergency situations happen daily when people least expect them. Training people to react in the correct manner and ultimately save lives is vital. Realistic training is a key element in giving people the right tools to manage situations that may occur in their environment.

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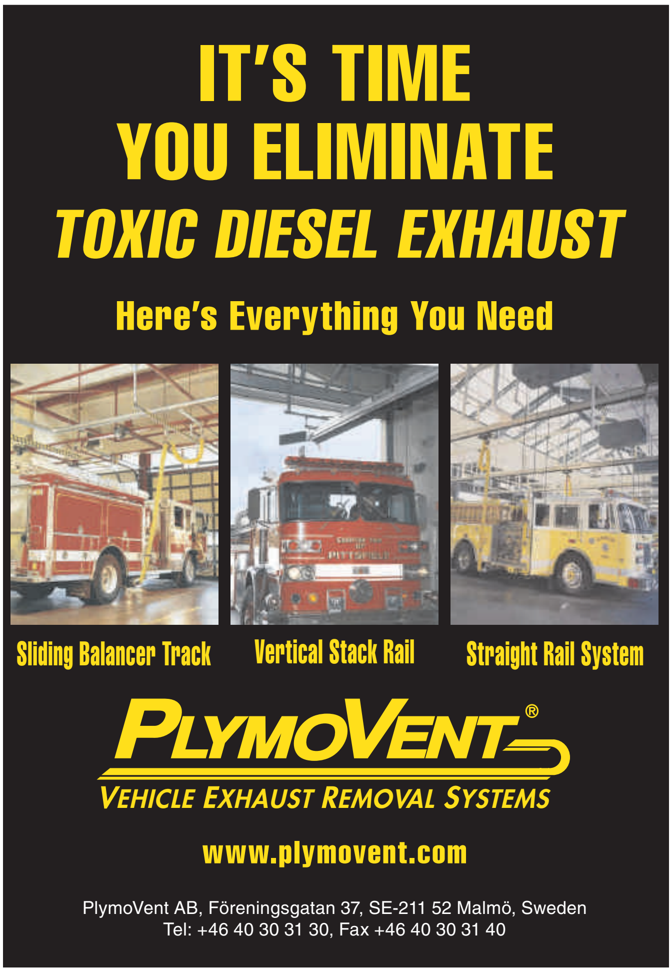
FBT students, about to enter attack unit

College the general consensus is that a branch should be capable of producing a variety of streams ranging from fog through a spray to a solid jet. For a small compartment fire, it is widely believed that a 30–60 degree cone, producing a fine fog of water at a flow rate of approximately 100–150 litres per minute is suitable for the control of fire gases. Traditionally, British fire fighters normally carry out an initial attack on a fire using a hose reel. This consists of a 19mm hose with a small branch operating at approximately 20 bars. It was quickly discovered at the College, when the new pulse techniques were introduced, that most branch and coupling designs were inadequate for the task. To operate smoothly at 20 bars and to give a pulse of short duration, it has been found that a branch with a slide design has distinct advantages over a ball valve. The water hammer produced by pulsing a branch can easily burst couplings or damage pumps. Macdonald couplings with a screw-down lock facility produce a strong and secure option. The College has provided advice to a number of branch manufacturers on branch design requirements. One such piece of advice is that, ideally, within the cone there should be an even distribution of water rather than just at the rim. This would ensure that there is an optimum spread of small water particles to absorb heat and control the fire gases.

THERMAL IMAGE CAMERAS

There has been little development by most Brigades into the operational use of Thermal Image Cameras (TIC). A TIC is not always considered when making an initial entry despite it's proven ability to provide significant assistance in quickly locating casualties and/or the seat of the fire. Reasons cited, to name a few, include a lack of faith in reliability, concerns over intrinsic safety and resistance for moving away from traditional, proven search procedures. The latest generation of TICs however, provide an excellent and versatile search tool. They can produce coloured images showing temperature variation, take digital stills thereby preserving forensic information before it is altered by the developing fire situation and can send live images via telemetry to the Incident Commander. The latter gives the Incident Commander valuable information on the fire's development and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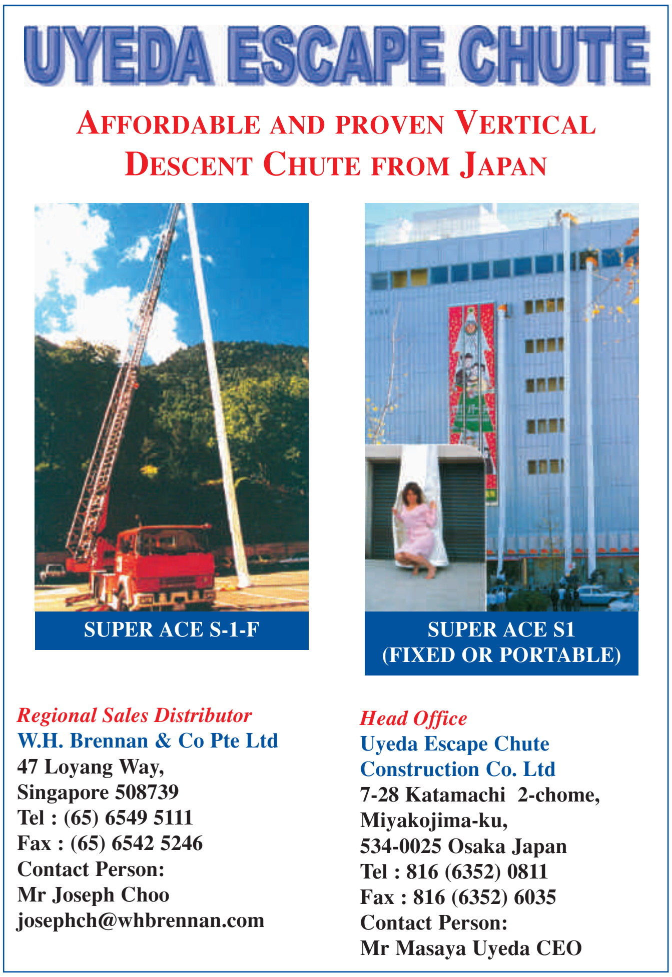
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assists in the dynamic risk assessment and the continuous evolution of an operational plan.

Various College members feel that this is an area of BA training that requires development. It is hoped, should support from manufactures be forthcoming, that this can be investigated and pushed forward. It is interesting to note, from an Australian CFBT web site, that TICs are being used to record and study the nature of flash and roll-overs.

BA TELEMETRY SYSTEMS

The College uses the Draeger 94 plus Breathing Apparatus set fitted with the Bodyguard combined pressure gauge and Distress Signal Unit system. This set has proved itself to be reliable throughout all the use it has been subjected to. Its main drawback it that Bodyguard is a complex system and needs constant practise in its use to ensure that the general and daily safety checks are carried out correctly. With the regular turnover of students at the College, who are from a variety of backgrounds and possess a wide range of BA experience, the College has realised that it is not always possible for sufficient instruction and practice time, for the correct use of the Bodyguard system, to be given. The College has therefore modified the general safety check so those students can carry out the full range of required tests without incorporating all of the Bodyguards features. BA wearers who are competent in the use of Bodyguard can carry out the checks as normal.

Prior to backdraught

Draeger has recently developed the PSS Merlin BA Entry Control Board, which compliments the Bodyguard system. The Merlin Board uses telemetry to communicate directly with the Bodyguard unit via an attached radio unit. This allows the BA Entry Control Officer to interrogate the Bodyguard unit to establish cylinder contents, air consumption rate, time to whistle etc. The Merlin Board also has the ability to calculate Time of Whistle. Should the Incident Commander require all or part of the BA crews committed to the risk area, to be evacuated, then an evacuation signal can be transmitted via the Merlin BA board to the Bodyguard unit. Obviously, from an incident command point of view, Merlin has the ability to provide the Incident Commander with up to date information to assist them in making decisions and to be another valuable safety tool in the control of BA. It is expected, within the near future, that Draeger will make a Merlin board available for the College to assess and to incorporate within the training programme. It would be of particular use for the BA Instructors course where its capabilities could be tested to the full.

In Conclusion

There are a number of areas within BA training that can and should be developed. It is felt that the College has the facilities and expertise to play an active role in any such development.

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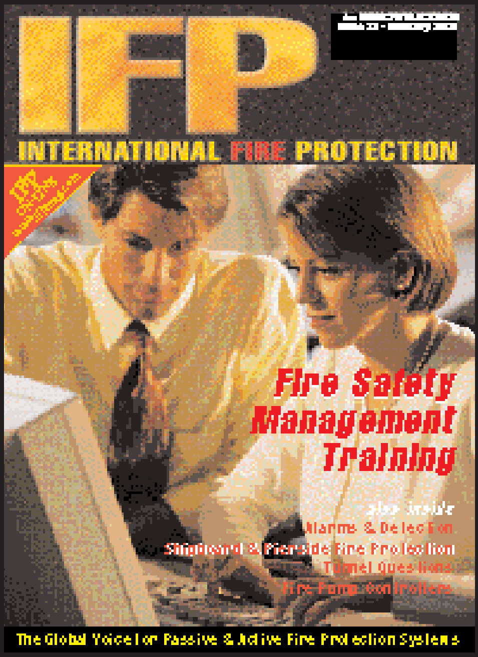
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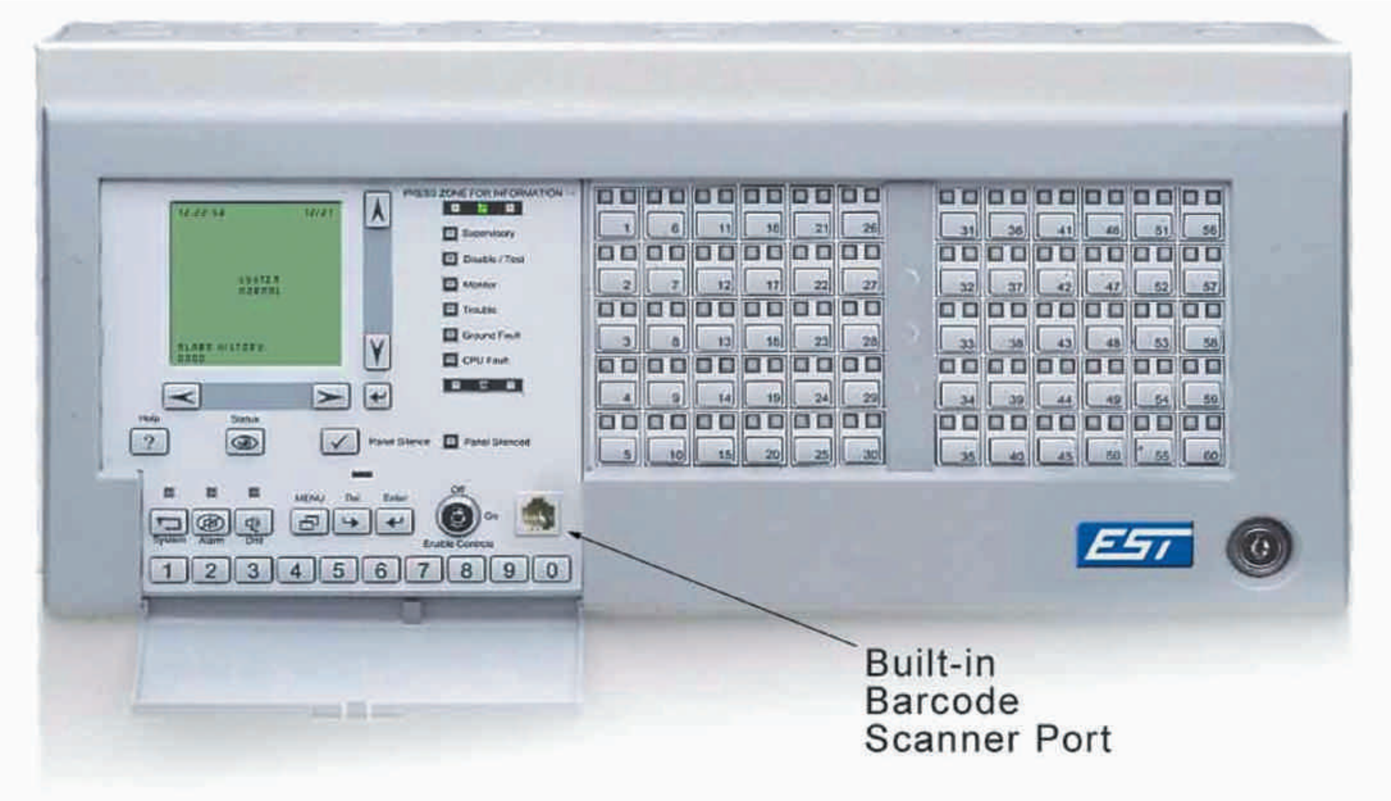

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No going back

ANALOGUE-ADDRESSABLE FIRE ALARM CONTROL has hit its stride among large and mid-sized applications. The question now is can the cost and configuration barriers be lowered enough to bring it to maturity among small building applications as well?

By Okay Barutcu

Only a short while ago, it seems, analogue-addressable fire alarm control panels were found only in highrise buildings, large campus-style installations, and commercial/industrial complexes. The truth was, microprocessor-based intelligence was simply too expensive for small building applications. The sophisticated technology didn't justify the expense in small buildings. But things have changed, especially during the past year or two, and the future of fire protection – for buildings of all sizes – is now inexorably tied to analogue-addressable control.

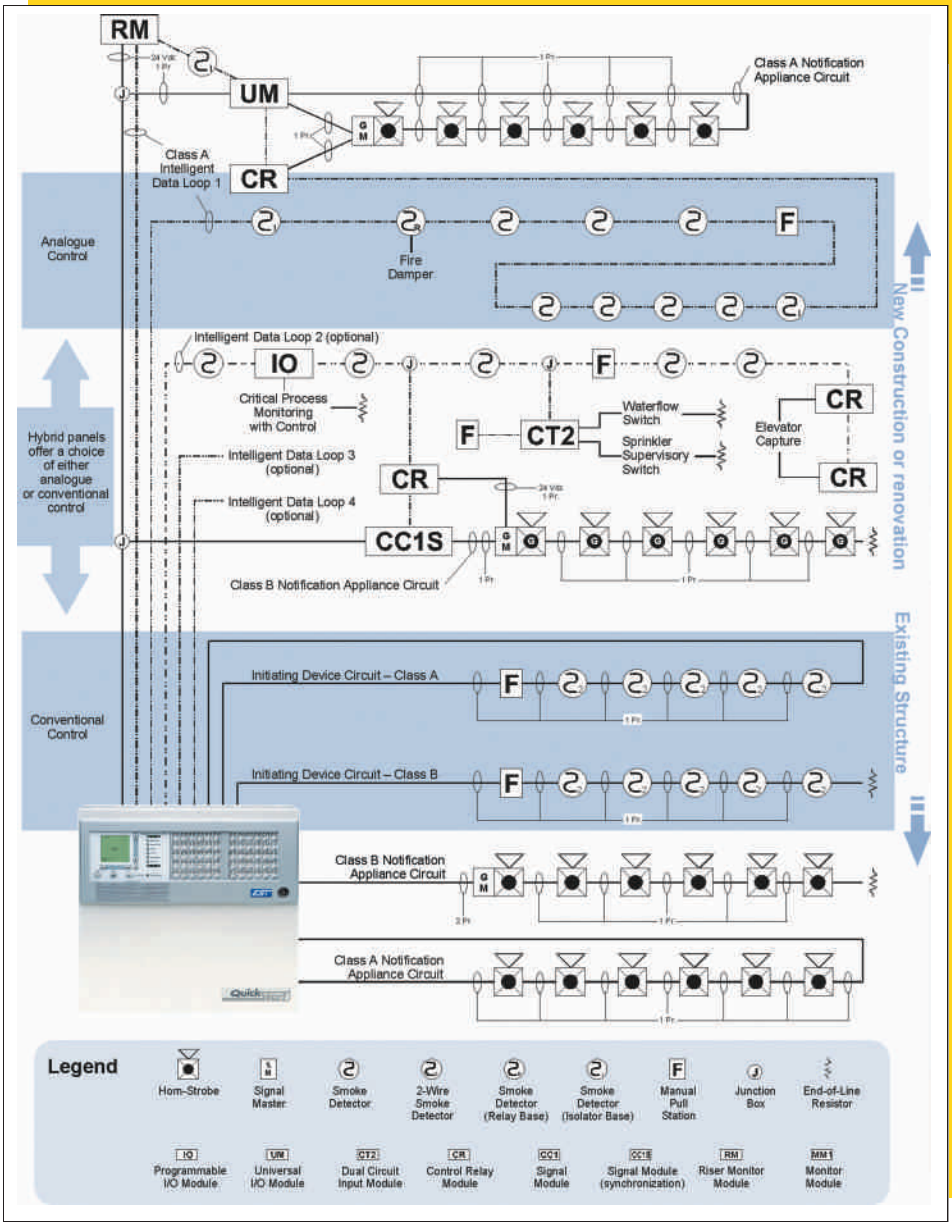
While some manufacturers have developed conventional products that support analogue-like features, true analogue-addressable fire alarm systems represent a significant improvement over conventional systems on the market today. First, with support for intelligent addressable devices, the state and condition of any device can be pinpointed and checked from the front panel. Conventional systems, on the other hand, are typically based on zoned control, which provides information only about the group of devices on a single wiring loop. If one detector is dirty or causing a trouble condition, all the devices on that loop need to be checked in the field, one at a time.

Analogue-addressable control also increases system reliability and reduces the chance of nuisance alarms. Unlike conventional systems, which only recognize when a device changes the state of a zone (i.e.: from normal to alarm), intelligent devices process information on a continuous basis. This means, for example, the device can track and compensate for the effects of the gradual accumulation of dirt, and will signal the control panel if it is in need of service long before it becomes ineffective or issues a false alarm.

This kind of self-diagnostics is particularly important when it comes to meeting the testing requirements of local fire codes. In fact, more and more panel-generated diagnostic reports are accepted in lieu of manual testing of each device. And that can save a lot of time, trouble, and expense on a regular basis.

ANALOGUE-ADDRESSABLE SYSTEMS GAINING MARKET SHARE

While analogue-addressable control has offered many distinct advantages over conventional fire alarm systems for quite some time, the trade-off in terms of expense and relatively complicated installation has kept it largely in the domain of large installations. Among larger systems an economy of scale has made the choice of an analogue-addressable system one that reaps significant benefits to both the contractor and the building owner. Until recently smaller installations could not justify that leap.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UM
1 Pr
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G M
Class A Intelligent Data Loop 1
CR
Analogue Control
Fire Damper
F
New Construction or renovation
Intelligent Data Loop 2 (optional)
IO
Critical Process Monitoring with Control
F
CT2
Waterflow Switch
Sprinkler Supervisory Switch
Elevator Capture
CR
CR
Hybrid panels offer a choice of either analogue or conventional control
Intelligent Data Loop 3 (optional)
CR
Intelligent Data Loop 4 (optional)
CC1S
Class B Notification Appliance Circuit
Existing Structure
Initiating Device Circuit – Class A
Conventional Control
Initiating Device Circuit – Class B
Class B Notification Appliance Circuit
2 Pr
Class A Notification Appliance Circuit
Quick
Legend
Horn-Strobe
Signal Master
Smoke Detector
2-Wire Smoke Detector
Smoke Detector (Relay Base)
Smoke Detector (Isolator Base)
Manual Pull Station
Junction Box
End-of-Line Resistor
IO Programmable I/O Module
UM Universal I/O Module
CT2 Dual Circuit Input Module
CR Control Relay Module
CC1 Signal Module
CC1S Signal Module (synchronization)
RM Riser Monitor Module
MM1 Monitor Module

Pic courtesy of Edwards International

Lately, however, the cost of analogue-addressable control has come down significantly. The price of microprocessors is low; on-board memory is relatively cheap; and manufacturers have recouped the high cost of development to the point where they can now offer the technology at less of a premium than before.

Not long ago contractors were reluctant to install such systems in buildings that required fewer than 1,000 detectors. Today industry insiders agree that this threshold has dropped to between 50 and 80 detectors. Small office buildings and lowrise residential complexes now make likely candidates for analogue-addressable control.

The most significant factor in the spread of analogue-addressable control to small building applications has been cost, but technology has played an important part as well. Sophisticated features at the high end of the scale have led to crossover products at the low end. Today manufacturers are able to offer scaled-back versions of technology originally developed for large applications. This technology is ideally suited to smaller applications because it's simpler to implement, easier to install, and economical.

HYBRID SYSTEMS MAKE TRANSITION TO ANALOGUE-ADDRESSABLE EASIER AND LESS COSTLY

Once complicated to program and configure, analogue-addressable systems are now loaded with features that streamline installation. Those very features are making them attractive for small building applications.

The most notable panels geared expressly for small buildings are the new generation of hybrid analogue/conventional systems. These offer low-cost conventional control, or cost-effective analogue-addressable control, or a flexible combination of the two.

Let's say you have a small building: new construction; twenty detectors – too small to justify an analogue-addressable system. But you know that the planned phase two of construction will quadruple its floorspace. A hybrid system is ideal for such an installation because it can start out as a conventional panel serving the first phase of construction for as long as necessary. For phase two of construction, the addition of a loop controller at the control panel will give it analogue-addressable capability to serve intelligent devices installed with the new construction. Meanwhile, existing conventional devices can be replaced with new intelligent devices and brought on-line at any time after the control panel has the added analogue-addressable capability. Existing field wiring can be reused, and the panel doesn't even need to be replaced. The cost of the job meets the needs of the application without committing to analogue control before its cost is justified. The end result is an analogue system for the entire building at a fraction of the cost of replacing an outdated control panel and all its connected devices.

The phased-in approach for new construction does away with the all-or-nothing limits of traditional analogue-addressable control. In retrofit situations the cost and performance benefits are even more significant because hybrid control panels offer a convenient and cost-effective migration path to analogue-addressable control.

This allows aging conventional systems to be replaced in stages. As areas of a building are renovated, conventional detectors can be replaced with intelligent devices according to a timetable that suits the owner's budget and renovation schedule. The change-over can occur so that it has the least impact on building occupants, for example, when a tenant's lease expires. Because there is no need to retrofit an entire fire alarm system at once, work can even be scheduled over a number of weekends – without any lapse in fire protection between visits by installers.

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INNOVATIONS MAKE ANALOGUE-ADDRESSABLE MORE ATTRACTIVE TO INSTALLERS

While the convenience of hybrid control panels have gained them significant headway in the market, systems geared for small buildings are now loaded with features that make them easier to install and service as well. Programming and configuration improvements streamline the process for installers so that they spend as little time on-site as possible.

One of the greatest advantages of analogue-addressable control over conventional systems is the support for addressable devices. With this support, an analogue-addressable panel can display details about the location and condition of any intelligent device on the system. The tricky part is registering the location and type of device with the system so that it can display these details when required. When the amount of time an installer spends setting up a system determines whether or not analogue-addressable control is a cost-effective solution, this factor takes on a great deal of importance.

Recognizing this, manufacturers have come up with several innovative shortcuts that speed setup and installation for analogue-addressable systems. Because every installation presents different challenges, look for a control panel that supports a range of programming methods, including laptop programming, barcode scanning, autolearning, and front panel configuration:

- **AUTOLEARNING** is a routine invoked by the installer after the field devices are connected. Much like the *search for new hardware* sequence found on today’s plug-and-play PCs, the Autolearn routine looks for connected devices and registers their device addresses with the control panel. Autolearn also determines whether any hardware options are installed with the control panel and makes sure they are working correctly. Autolearn is vital to any small building analogue control panel because it provides a base upon which device-level details can be built. While it identifies which devices are connected, it remains the installer’s next task to associate the device addresses with meaningful location information such as “CAFETERIA”, “3RD FLOOR WEST”, “UTILITY ROOM”, etc. This information is displayed by the control panel when required.

- **LAPTOP PROGRAMMING** is a method that was inherited from big analogue-addressable systems. It involves downloading data from the system, modifying it with a proprietary Windows® based software package, and then uploading the new data to the control panel. This method is useful for larger systems and where relatively complicated setup or extensive text inputting is required. It is also useful for associating text details with devices following the Autolearn routine. Panels that support laptop programming come with a port to which a laptop serial cable may be connected.

- **BARCODE SCANNING** is an innovative alternative to laptop programming for associating text with device addresses. Here’s how it works: each detector includes a unique address represented by a barcode that appears on the device itself and on the end-flap of the box it came in. As each device is installed, the installer simply

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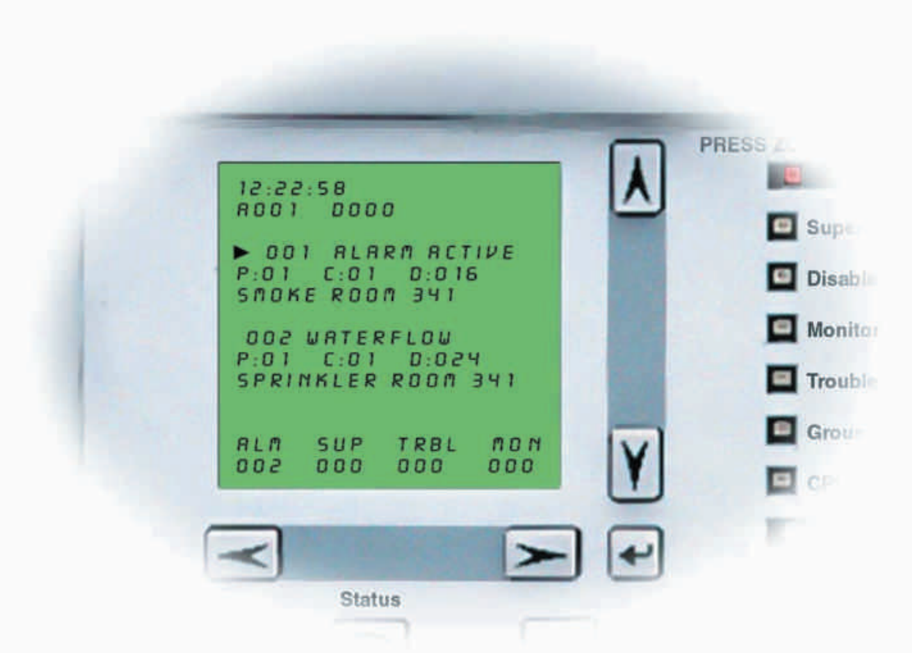

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12:22:58
A001   0000

▶ 001  ALARM ACTIVE
P:01   C:01   D:016
SMOKE ROOM 341

 002 WATERFLOW
P:01   C:01   D:024
SPRINKLER ROOM 341

ALM   SUP   TRBL   MON
002   000   000    000
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Pic courtesy of Edwards International

writes its location on the box next to the bar code and tears off the flap. Back at the control panel the autolearn sequence is run. Then the installer scans the bar code from the box flap and inputs the location information written next to it for reference. The control panel automatically associates the device address with the text information that follows. This text information may also be scanned into the system by means of a series of sheets carried by the programmer that has bar codes accompanied with plain language translations for text, digits, and frequently-used words such as “EAST”, “WEST”, “BASEMENT”, “ROOM”, etc. Control panels that support barcode scanning have built-in scanner ports that accept a connection for compact pencil-style barcode scanners. For routine programming and setup, this option provides the most convenient method of text and numerical input.

- **FRONT PANEL PROGRAMMING** is a viable option for initial system setup and for making minor changes to text and numerical data. Text input for more than a handful of devices, however, can quickly become tedious and time-consuming, even among control panels that have dedicated buttons for each letter in the alphabet. Unlike barcode scanning, there are few shortcuts for repetitive text, and unlike laptop programming, there is no familiar QWERTY-style keyboard to speed text input.

INNOVATIONS DRIVE THE FUTURE

Analogue-addressable control panels offer the versatility and reliability of intelligent fire alarm systems, making built space safer to occupy than ever before. They are far better at what they do than conventional systems with zoned control. While barriers to the universal acceptance and application of analogue-addressable systems remain, these barriers are rapidly coming down. Lower overall cost, the convenience of hybrid systems, and innovations such as autolearning and barcode scanning are all working in favour of analogue-addressable control panels as they edge out traditional conventional control in the world markets today.

The future of small building fire alarm control will undoubtedly reflect innovations and developments among analogue control addressable panels. As we continue to lower the feasibility threshold for analogue-addressable systems and extend their reach into ever-smaller applications, conventional systems will diminish in importance. Whether analogue-addressable systems will eclipse conventional control altogether remains to be seen. But one thing can be said for sure: once analogue-addressable takes hold, there is no going back.

Okay Barutcu is Regional Director, Europe and South Africa, for EST International. He is based in Arundel, UK.

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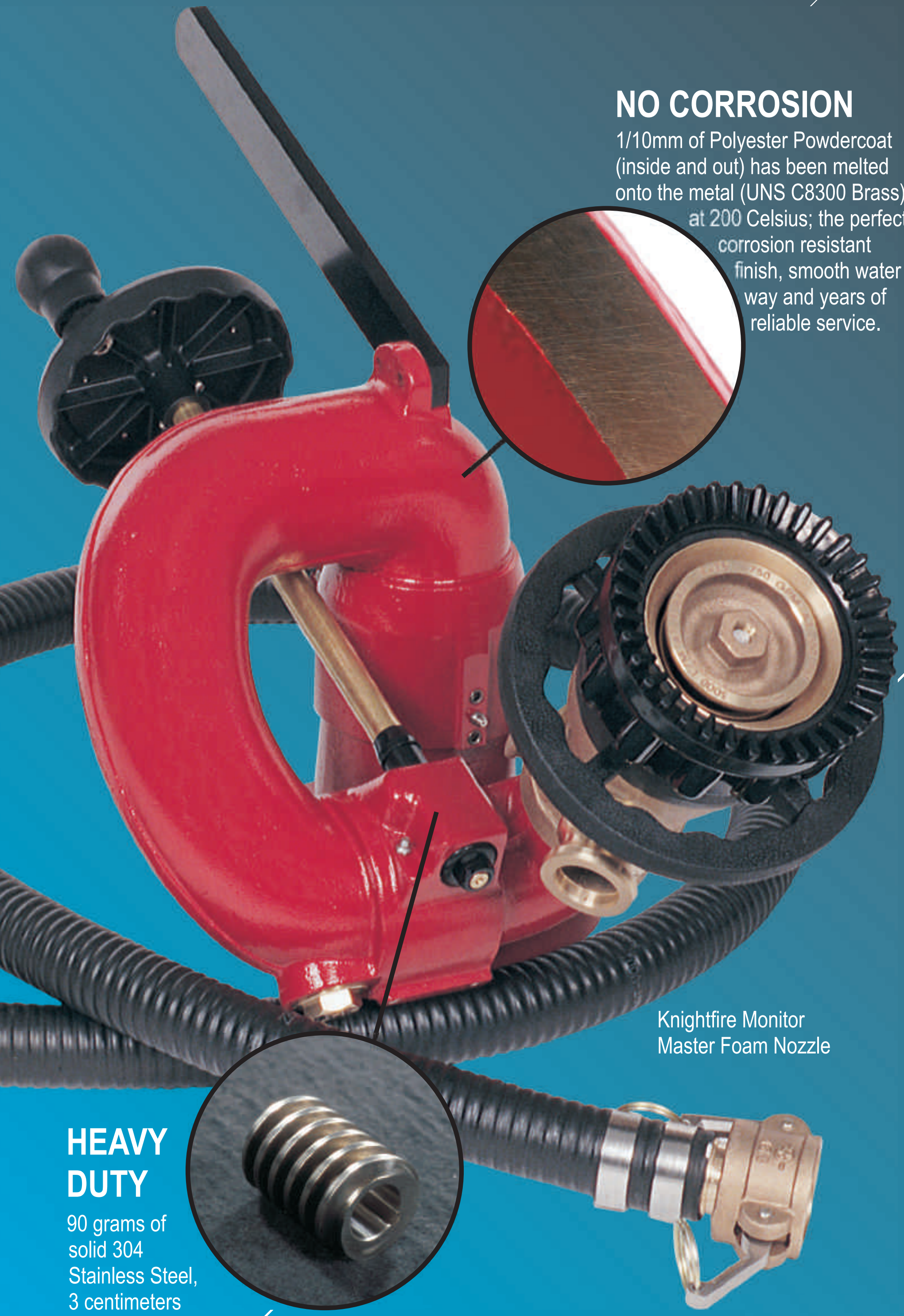

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Weight	Monitor 10.5 kg / Base 17.5 kg	Monitor 14 kg / Base 17.5 kg	Monitor 13 kg	Monitor 12.5 kg/ Base 17.5 kg
Material Used for Legs	Aluminum	Aluminum	Aluminum	Aluminum
Quoted Output (lpm)	3030 ground/ 4800 deck	3030 ground/ 4800 deck	1420	2900
Final Finish	Painted	Painted	Painted	Painted
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Model Number	365/570	366 / 567	376	377	378	379
Origin	Germany	Germany	Germany	Germany	Germany	Germany
Material Used for Monitor	Aluminum (Gunmetal Option)	Aluminum (Gunmetal Option)	Aluminum (Gunmetal Option)	Aluminum (Gunmetal Option)	Aluminum (Gunmetal Option)	Aluminum (Gunmetal Option)
Material Used for Legs	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Weight	8 kg	10 kg	35 kg	87 kg	240 kg	450 kg
Quoted Output (lpm)	2000	4000	8000	16000	32000	60000
Final Finish	Coloured Red or Coloured to Customers Specification	Coloured Red or Coloured to Customers Specification	Coloured Red or Coloured to Customers Specification	Coloured Red or Coloured to Customers Specification	Coloured Red or Coloured to Customers Specification	Coloured Red or Coloured to Customers Specification
Delivery Times	Basic Units promptly available Custom Tailored, complete Units upon Request	Basic Units promptly available Custom Tailored, complete Units upon Request	Basic Units promptly available Custom Tailored, complete Units upon Request	Basic Units promptly available Custom Tailored, complete Units upon Request	Basic Units promptly available Custom Tailored, complete Units upon Request	Basic Units promptly available Custom Tailored, complete Units upon Request
Unique Features	Easy to service, low maintenance, basic units to allow adaption to varying requirements, e.g actuators, pipes and nozzles	Easy to service, low maintenance, units to allow adaption to varying requirements, e.g actuators, pipes and nozzles	Easy to service, low maintenance, units to allow adaption to varying requirements, e.g actuators, pipes and nozzles	Easy to service, low maintenance, units to allow adaption to varying requirements, e.g actuators, pipes and nozzles	Easy to service, low maintenance, units to allow adaption to varying requirements, e.g actuators, pipes and nozzles	Easy to service, low maintenance, units to allow adaption to varying requirements, e.g actuators, pipes and nozzles

Albach GmbH & Co. KG
Konigsteiner Strasse 58
D-65929 Frankfurt/Main (Hochst)
Germany
Tel: +49 69 33 99 38 0
Fax: +49 69 33 99 38 22
Website: www.alco-frankfurt.de
<http://www.alco-frankfurt.de>

ANGUS FIRE

Product Name	Streamline PGM Portable Ground Monitor	Titan Self-inducing Bipod Foam Monitor
Origin	UK	UK
Material Used for Monitor	Aluminium Alloy and Stainless Steel	Aluminium Alloy and Stainless Steel foam barrel
Material Used for Legs	316 Stainless Steel	316 Stainless Steel
Weight	Just 7 kg (without nozzle)	41 kg
Quoted Output (lpm)	900-2200 Litres/min (depending on nozzle)	4500 Litres/min at 10 bar g.
Final Finish	Red thermoplastic (non-chip), natural legs	Yellow thermoplastic (non-chip), natural barrel
Delivery Times	In stock	In stock
Unique Features	Compact, low maintenance, low pressure loss, quick and easy to set up	Applies good foam blanket onto bulk tanks, low pressure loss, 2 man portable, quick and easy to operate
Warranty	12 months	12 months

Angus Fire
Thame Park Road, Thame
Oxfordshire OX9 3RT, UK
Tel: +44 1844 265003
Fax: +44 1844 265 156
Website: www.angusfire.co.uk
<http://www.angusfire.co.uk>

ELKHART BRASS

Product Name	Stinger 2.0
Origin	USA
Material Used for Monitor	Cast Aluminium
Material Used for Legs	Forged Aluminium
Weight	27 lbs
Quoted Output (lpm)	3030
Final Finish	Red Paint
Delivery Times	30 Days
Unique Features	Dual Purpose. Can be used as a Deck Gun

Elkhart Brass Mfg. Co., Inc.
1302 West Beardsley Avenue, Elkhart, IN 46515, USA
Tel: +1 574 295 8330 Fax: +1 574 293 9914
Website: www.alkhartbrass.com <http://www.alkhartbrass.com>

TASK FORCE TIPS

Product Name	Crossfire	Blitzfire
Origin	USA	USA
Material Used for Monitor	Hardcoat Anodized Aluminum	Hardcoat Anodized Aluminum
Material Used for Legs	Stainless Steel with Carbide Tips	Stainless Steel with Carbide Tips
Weight	11.5 kg	9.9 kg
Quoted Output (lpm)	4800 lpm	1900 lpm
Final Finish	Powercoat Inside and Outside	Powercoat Inside and Outside
Delivery Times		
Unique Features	Safe-Tak Flow Safety Valve Folding Legs Easily Transfer from Truck to Ground Use	Safety Shut Off Valve 6-detent Flow Control Valve Oscillating Attachment Folding Legs Safely Operates at 10 degree angle
Warranty	5-year warranty	5-year warranty

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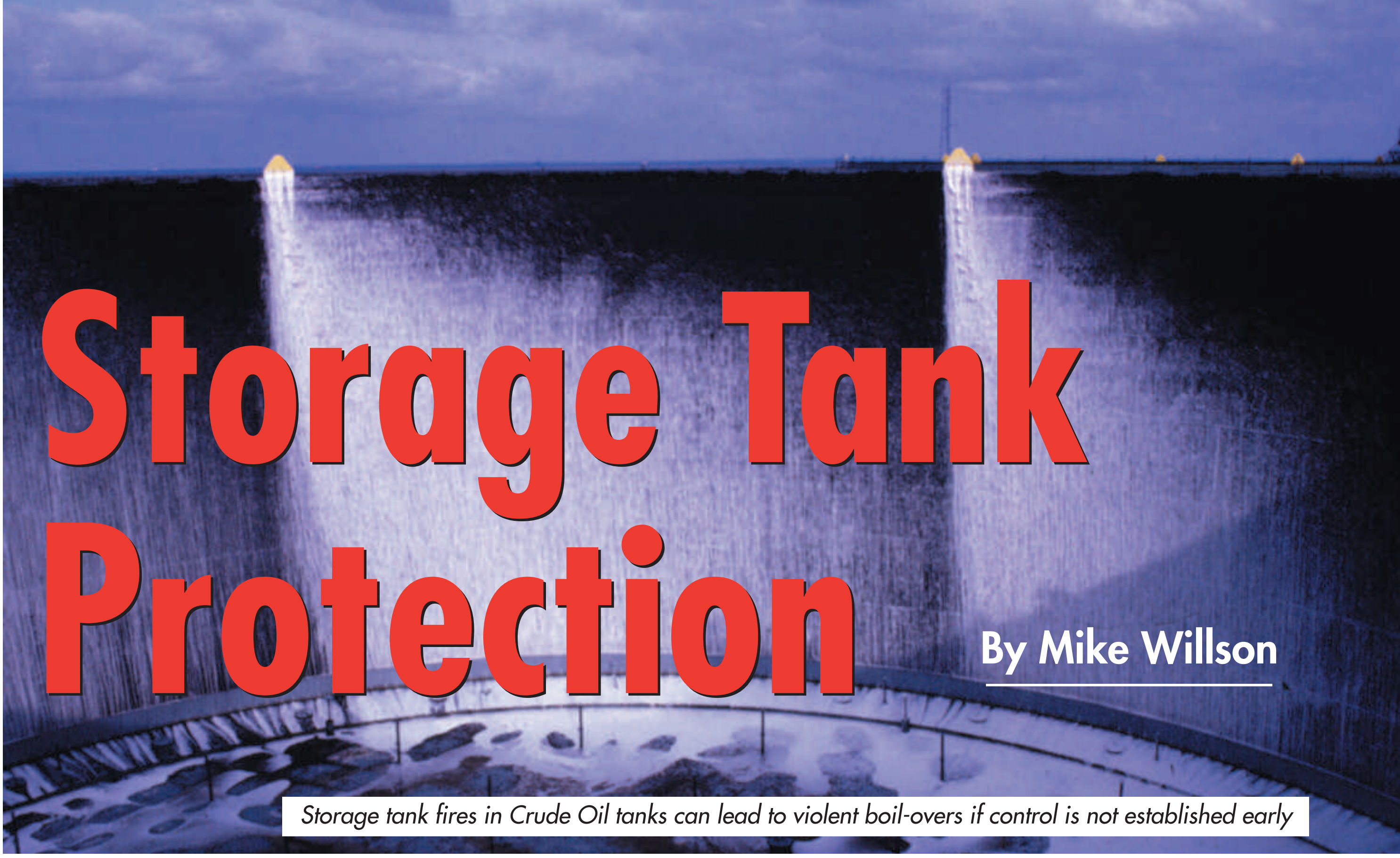
Storage Tank Protection

By Mike Willson



Storage tank fires in Crude Oil tanks can lead to violent boil-overs if control is not established early

Why Do We Need Fixed Foam Systems?

OIL-BASED PRODUCTS are increasingly being used as both a prime energy source and a basic feedstock for other petrochemical and pharmaceutical industries. This, coupled with the need to hold strategic stocks, means that very large quantities of these volatile products are stored in vertical bulk storage tanks. Tanks are found at numerous locations in the chain of distribution between the producing field, the refinery and petrochemical plants, loading jetties, distribution terminals, pipelines, downstream industries and the consumer products we all need, like heating, fuel for cars, plastics, paints, medicines and so on.

Fires in these tanks pose specific problems for both the professional fire fighter and the fire design engineer, which grow dramatically the longer the fires burn. Large quantities of flammable liquids are involved, which become increasingly difficult to control and extinguish the hotter they get.

Clouds of noxious smoke are given off into the atmosphere and toxic liquids may escape into water courses and rivers during an incident. It is vitally important to control and extinguish such fires quickly and efficiently to minimise their environmental impact.

Such swift action can also minimise the loss of these non-renewable energy resources, that help generate valuable foreign currency on international markets. Lets now look at how we should protect these valuable assets, to ensure we achieve effective fire protection and minimise the consequential losses in an incident.

FAST RESPONSE CRUCIAL

The most reliable means of ensuring that a fire fighting attack can be commenced immediately after a fire has been detected, is by ensuring that the fire protection equipment is already in position, which means having a fixed foam system permanently installed in the hazardous area.

This avoids answering lots of questions once the fire starts. Questions like:

- What are the required foam application rates?
- What are the water supply requirements?
- What fire pump capacities will be required and how can we achieve them?
- How much foam concentrate will be needed?
- What delivery equipment do we have to apply the foam – above the critical application rate?
- Can we get enough water pressure to project the foam onto the tank?
- Which way is the wind blowing?
- Are there sufficient fire hoses in good condition?
- What about cooling the other tanks?

WHY FIXED SYSTEMS?

There is **insufficient time** to start calculating the logistical requirements to extinguish the fire once it starts, and valuable time can be wasted in setting up large monitors and all the supply hoses to feed them. Whereas for fixed foam systems the equipment is already connected and these questions are all answered during the design phase before an incident occurs, so the system is ready to go at the press of a switch to take a pre-determined course of action to achieve the desired fast control and extinction. Fixed foam systems take all the "guesswork" out of fighting a tank fire, and normally use lower application rates than over the

Angus Fire's HBPG Base injection system protecting hydrocarbon tanks

top monitor systems in recognition that all the foam is delivered onto the fuel surface where it can combat the fire.

In many ways fixed and semi-fixed systems are victims of their own success – regularly they operate and extinguish fires, while they are still small. There is no drama, no crisis, no adverse publicity because the foam system provides valuable cooling, seals the vapours, prevents re-ignition and quickly extinguishes the fire while it is still small and remains a "minor incident".

- **before** it has had a chance to have a large environmental impact
- **before** it has drawn any media attention
- **before** it has caused extensive damage to on-line processes or surrounding plant
- **before** it has endangered personnel or incurred vast cost to bring under control.

A fixed foam system can be your best friend, for each day it helps to **minimise** the environmental impact of accidents involving flammable liquid storage around the world. Reducing the risk to site personnel as well as the general public, reducing any legal liability and reducing the potential for media interest are all hidden benefits of fixed foam systems. At the same time they are working to **minimise** the disruption to other plant processes on site, **minimise** the cost of repair, **minimise** the product losses and importantly **minimise** the impact on neighbouring plants.

To be able to provide efficient protection in this way, fixed foam systems require three things from the end user organisation:

1. Initial **commitment** to invest in the installation of a professionally designed and engineered fixed foam system, using high quality components for reliability and long life. Cost cutting here can lead to inferior equipment or system design that will give problems later.
2. Run **commissioning** trials once installed, to prove the correct action is being taken by the system. This is very important to satisfy senior officials and insurance companies that the system will work if needed.
3. Implementation of a system **maintenance** programme with full system testing – at least annually. Reliability, ease of inspection and low maintenance will be important decisions in selecting the specific types of equipment to be used in the system.

TANK TYPES

Storage tank protection accounts for approximately 70% of all fixed foam system installations.

There are three types of bulk storage tank for hydrocarbons and polar solvents commonly found in service. In terms of popularity these are:

1. **Fixed cone roof**
2. **Open top floating roof**
3. **Covered internal floating roof**

We also need to consider their surrounding bunds/dike areas.

The selection of the most appropriate system will depend upon the construction of the tank and the fuel stored in that tank.

For fixed cone roof tanks containing hydrocarbons, both base injection and top pouring systems are normally acceptable. However if the tank contains any polar solvents or water miscible fuels then top pourers are the normal choice. Furthermore polar solvents demand the use of specialised multi-purpose or alcohol resistant (AR type) foam concentrates like Niagara AR-FFFP or Tridol AR-AFFF.

BASE INJECTION

The concept of base injection or sub surface foam injection only became feasible with the development of high quality fluoroprotein type foam concentrates like FP70, which have a high resistance to contamination by fuel and have good fluidity.Hence this is still the most popular, cost-effective and efficient foam for hydrocarbon tank protection. These fires are likely to be deep-seated and have been burning for longer than spill fires when the foam arrives. The finished foam must therefore have excellent burn back resistance and stability. Good FluoroProteins exhibit all of these characteristics.

In operation base injection systems introduce a very low expansion foam at a pre-determined application rate at the base of the tank through a High Back Pressure Generator (HBPG) above the water level. The foam then rises through the fuel to form an extinguishing blanket at the surface, dragging cold fuel up with it to disperse and cool the hot fuel zone at the surface. It is important that the HBPG is capable of working against the head pressure of product in the tank as well as pressure losses in the supply pipework. The most effective units have twin pressure gauges to easily check that the unit is working correctly and the back pressure does not exceed 40% of the foam solution inlet pressure. An integral

> *In operation base injection systems introduce a very low expansion foam at a pre-determined application rate at the base of the tank through a High Back Pressure Generator (HBPG) above the water level.*

Integral UL listed TPS 100 unit gives exceptional performance and reliability

non-return valve is also important to ensure there is sufficient energy to rupture the vacuum supported bursting disc as operation begins. Should line pressure fluctuate so that the unit stalls, the non-return valve prevents fuel from the tank spilling out of the generator air intake holes into the bunded area, which could cause a serious escalation of the fire.

Advantages of base injection system are:

- Rapid response with the optimum use of foam and water resources.
- The design application rate (minimum 4.1 L/min/m^2) of foam solution is achieved.
- Because the system components are located at ground level normally outside the bund area, they are less likely to be damaged in the event of fire or explosion.
- Base injection systems are simple to retro-fit, operate and maintain.
- Valved take-offs from existing product lines may be suitable as foam inlets, provided the entry velocity of the finished foam does not exceed the design rates. This can avoid tank de-commissioning during installation.
- 40% back pressure capability allows downstream pipes between the generator and tank to be reduced, which can greatly reduce the overall system installation cost.
- Rotational currents caused by the rising foam stream carry cold fuel to the burning surface which can aid extinction by dissipating the hot zone. Tests have shown that surface temperature can quickly be reduced by up to 100°C by this circulation effect.

All these factors make for a more flexible and cost-effective use of available resources.

TOP POURING SYSTEMS

Top Pourer Sets or foam chambers deliver low expansion foam from above the fuel surface onto the tank shell to run down on to the surface, particularly important on polar solvent fuels. Suitable for use on fixed roof or covered floating roof tanks, top pouring systems are normally designed on the basis that the full surface represents the hazard area. Application rates recommended in international standards like NFPA11:2002, call for minimum application rates of 4.1 L/min/m^2 for hydrocarbon fuels and 6.5 L/min/m^2 or more depending on the polar solvent involved.

The system components are therefore sized accordingly and will comprise a suitable foam concentrate induction device, a combined foam generator,

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TANK PROTECTION
Foam is the most reliable and only environmentally friendly alternative when it comes to fire protection of storage tanks for flammable liquids. The tank protection equipment are made of high grade materials and complies with NFPA. Used by most major oil companies.

PROPORTIONER
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Scorchmark visible on side of storage tank

pourer and vapour sealing mechanism in a single robust, low maintenance integral unit. The vapour sealing glass disc prevents flammable vapour escaping to atmosphere through the foam line, eliminating any consequent fire or explosion hazard.

Modern top pouring sets are factory calibrated to give the precise flow and pressure requirements of the system design. A new orifice plate can be provided to adjust flows to meet any pipework routing changes during installation for optimum flexibility. This allows the design engineer to make the most cost-effective use of the foam, water and pumping resources available on site.

Top pouring systems are also suitable for the protection of polar solvents or alcohols when used in conjunction with a suitable natural based alcohol-resistant foam concentrate such as Niagara for minimal environmental impact. An integral design of deflector is important as it simplifies installation and ensures the foam is dispersed against the tank shell to minimise turbulent mixing and reducing the application velocity. This ensures less fuel pick-up and a more rapid spread across the fuel surface. Equally important is the unit's ability to be tested without foam entering the storage tank, and without use of additional plates to block off the pourer which could then be forgotten and left inside after testing – which could disable the system in the event of fire!

Top pouring system advantages/disadvantage:

- Design application rates are achieved with all foam reaching the fuel surface.
- Robust and simple to operate.
- Can be tested in situ.
- Top pouring equipment may be susceptible to damage in the event of an explosion, when the roof intentionally blows off to prevent rupturing the tank.

Alternative systems using Large Capacity Monitors will be discussed in the next issue.

OPEN TOP FLOATING ROOF TANKS

These tanks have come into wide use all over the world because of the operational advantages they can offer over fixed roof tanks. They earn their keep by reducing costly evaporation losses and eliminating any vapour space above the fuel, hence reducing the fire risk.

For many years it was believed these tanks were so safe that fires were unlikely to occur. Many subsequent fires including Milford Haven in the UK have shown this is not necessarily the case and as a result a fire protection system to protect the rimseal became in many cases a necessity.

The main area of vulnerability to fire in these tanks is in the enclosed space at the seal between the floating roof itself and the tank shell. If the seal is damaged in any way, vapour will collect which can be ignited by lightning or sparks produced either by friction or static electricity.

CONVENTIONAL RIMSEAL POURERS

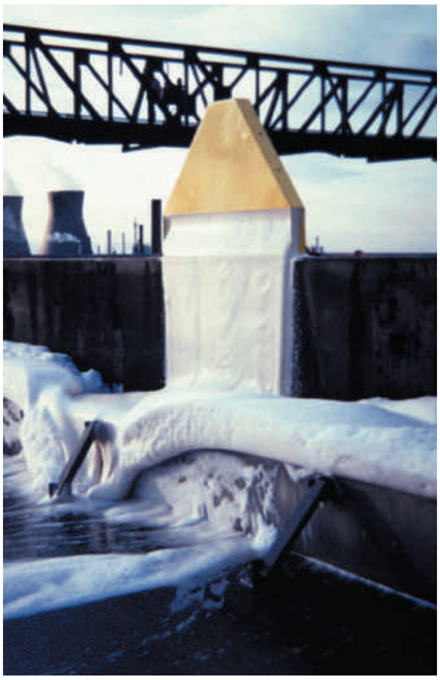
Rimseal pourers are fixed to the rim of the tank shell and should be designed to pour aspirated foam down the inside of the tank wall and into the seal area. To apply expanded foam effectively above the seal a foam dam must be fitted to the floating roof to prevent de-stabilisation from foam spreading across the roof. By containing the foam in this way sufficient depth should be achieved to flow laterally around the seal perimeter to the point where the seal may be damaged.

To take account of the much smaller surface area of the risk the foam generating equipment is sized accordingly. Fabricated pipe sections produce foam of poor quality that is frequently carried from the tank wall by the wind, so a specially designed unit with known foam properties should be used like the market leading yellow triangular Rimseal Pourer Sets.

An important consideration when selecting rimseal foam generating equipment is the ability to generate a coherent foam stream which will adhere to the tank shell and not be affected by wind – particularly important when the roof is low. The use of natural FP70 foam will assist this effect since it is more sticky than synthetic detergent based alternatives and will remain for longer as a protecting foam blanket in the seal area.

In addition quick and easy installation with a special fixing kit allows quick and easy retro-fitting without the need for hot work or tank decommissioning when riser pipes are already in place. The best units are factory calibrated to meet the specific flow and pressure conditions of the system design for a quick and easy upgrade of poorly performing or corroded units at minimal cost.

The other system widely used on such tanks during the 1970/80s was the BCF halon rimseal system. This was a fast acting technique to attack the fire early in its development, with sprinkler bulbs located in the rimseal area to detect a fire, connected to a central halon bottle for discharge. Early detection of most fires took place and a rapid short burst of halon was



Effective design of Rimseal Foam Pourer crucial to minimise adverse effects of wind applied to the area. This proved to be effective on several occasions, however, the system did have numerous problems, including gas escaping the seal area, maintenance difficulties and the leakage of halon from the storage cylinders before they were required to operate.

Due to its ozone depleting effects such halon systems are considered unacceptable for such applications. Clearly it has now become a matter of urgency to remove these halon systems and find a suitable replacement.

OPTIONAL SELF-CONTAINED RIMSEAL SYSTEMS

New developments in foam equipment technology have provided a better Floatafoam solution to replace these halon systems and supplement conventional Rimseal Pourers. Detection tubing is ruptured by heat from a fire, the drop in pressure automatically triggers discharge of the water taking foam with it from a micro-inductor and delivering it through special aspirating nozzles onto the fire. Using this technique detection is very rapid (10–15 seconds) and as a result, extinction of the fire is also very fast – typically under 20 seconds for a fully involved seal fire. The use of pressure switches on both nitrogen supply and foam discharge lines provides a signal to the alarm panel, alerting fire fighters to any change in status of the system. This provides reliable, effective and efficient replacement for these halon systems.

In developing this better foam system, key considerations are:

- Any self-contained foam system must be capable of extinguishing three types of fire, a small hole in the seal material, large tear where the seal area is exposed and a shoe gap fire. A fire may go undetected for many hours, especially when the roof is at a low level in the tank, so a reliable detection system is essential.
- In the unlikely event that a system fails to extinguish a fire, the aspirated foam blanket must be delivered gently and control burnback for more than 15 minutes.
- The small hazard area requires a high foam application rate to ensure the fire is contained before any escalation occurs.

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- Foam concentrate should be stored in a separate reservoir and capable of providing the required levels of heat resistance and fluidity in the seal area could only be achieved by using Alcoseal.
- The system needs to be free of electrical components, using nitrogen gas filled linear heat detection tubing in 40metre segments to avoid any electrical contacts/ignition risks on the roof.

COVERED FLOATING ROOF TANKS

For covered floating roof tanks with light plastic or aluminium membranes, it is usual for the membrane to melt or sink in the event of a fire. Top pourer sets are again the preferred option, with the possibility of base injection dependent upon the floating roof construction. The danger with base injection on these tanks is that outlets can easily be blocked if the roof sinks or distorts. These tanks are generally viewed like Cone Roof Tanks above, for foam fire protection.

BUND/DIKE PROTECTION

In the past most fire fighting professionals have seen bund fires as being of secondary importance, but views are now changing. Evidence from recent major fire incident reports suggest this is a serious high risk area and should be protected. Many of these fires have either started or seriously escalated within the bunded area surrounding the bulk storage tanks themselves.

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Some of the world's largest fires have become so large and "Infamous" simply because there was no adequate system of bund protection – and it keeps happening!

STANDARDS

Historically, the main foam system standard for the Oil industry NFPA 11 (National Fire Protection Association) in America provided no guidance on bund fires, offering only general guidelines for "supplementary protection" in storage tank bunded areas by using monitors and mobile AF120 foam units, which are very popular for spill fires in refineries and other industrial areas as it is so quick and easy to use. The latest revision NFPA 11:2002 now recommends low level foam discharge outlets (pourers) at 4.1 Litres/min/m^2 over a 30 minute operating period for Class 1 hydrocarbon bunded areas (20 mins for Class II). The British Standard BS5306 Section 6.2:1989 was the first international standard to take bunded areas seriously as a hazardous area, and made specific recommendations of 4 Litres/min/m^2 for 15 minutes using Medium Expansion (MEX) Pourer Systems.

The most common causes of serious bund incidents over the last 10 years have included leaking flanges, faulty valves, pump failures, electrical sparks, tank over-filling, blocked roof drains, pipeline ruptures, boilovers, lightening and of course spillage during maintenance work.

Angus Fire's popular MEX Bund Pourer in action

Angus Top Pourer Set discharging foam in a butterfly shaped dispersion pattern into an oil storage tank

Incident escalation in the bund often forces firefighters to retreat rapidly, the fire may destroy or damage hoses and portable equipment, severely limiting the capability for further attacks. Forceful application of foam with monitors and handlines can spread the fire more quickly by splashing burning fuel into new areas, rapidly escalating the incident. All these factors also increase the risk to site personnel by reducing their personal safety.

BUNDS: THE WAY FORWARD

The latest advance in this area of protection has come from MEX Bund Pourers producing a free-flowing yet stable medium expansion foam blanket (typically 35-55:1) which acts swiftly to attack the fire by quickly producing large volumes of fluid yet bulky foam. Having a number of fixed MEX pouring outlets avoids the need for personnel to be close to, or inside, the bunded area and thereby increases the safety of firefighters at the incident.

These MEX bund pourers also employ a gentle application technique. The rapid production of a vapour sealing foam blanket gently floated across the fuel surface minimises any mixing with the fuel, avoids splashing and escalation and maximises protection against reignition – especially where FP or FFFP foam is used. MEX foam also buries and cools pipework, flanges and valves, minimising the risk of rupture or further distortion thereby reducing fuel leakage rates.

The free-flowing nature of the MEX foam gives fast knockdown, yet its cohesive nature is also very stable against wind, particularly when more sticky natural FluoroProtein based foams like FP70 are used.

A further benefit is the optimum MEX production at very low inlet pressures, typically 1.5–3 bar.g. Consequently pumping capacities are minimised and cost-effective simple fixed inline inductors can easily be used. The pressure drop through the inductor venturi (which can result in poor performance for low expansion monitor equipment) can be a positive benefit in MEX systems, as a way of losing excess pressure.

The effectiveness of MEX foam for bunds has been recognised in the British Standard with a reduced 15 minute operating time. Significant savings can therefore be made in terms of foam stockholding, pumping capacities and water storage when MEX is being used. Angus Fire's latest advance with their unique MEX bund pourers provides the most reliable and cost-effective solution to the bund protection problem.

CONCLUSIONS

Fixed Foam Systems take the "guesswork" out of fighting storage tank fires and can provide swift, efficient fire protection to control the fire whilst still small and avoid escalation. Considerable importance should be given to ensuring that the very best performance is obtained from your fixed systems in terms of reliability and low maintenance. A good foam will not perform at its best through poor quality equipment, neither will poor quality foam produce the best performance from excellent equipment! You get what you pay for at the end of the day!

It is also crucial to ensure that any foam system is regularly tested. It is advisable to operate your foam systems and produce foam at least annually, to ensure they are in a state of readiness to help in your hour of need.

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FIRE GUANGDONG 2003

May 13-16, 2003

Jinhan Exhibition Hall of China Foreign Trade Center, Guangzhou

Approved by: Guangdong Provincial Public Security Department
Organizer: Guangdong Provincial Fire Protection Association
Co-organizer: Fire Protection Bureau, Guangdong Provincial Public Security Department
Science & Technology Section, Guangdong Provincial Public Security Department
Host: Union Fair & Trade Co., Ltd.

China is becoming the World Biggest Market on Fire Prevention

This century China is entering into an era of unprecedented change both politically and economically. This is marked chiefly by China's entry into the World Trade Organization, the privilege of hosting the 2008 Summer Olympics, as well as the continued economic development of the Western Regions. All of these events are creating exciting opportunities in the one of the most dynamic economies on the Asian continent.

Despite all of these advancements, China's fire prevention industry lags behind in relation to its growth in GDP. China remains one of the most fire prone countries in the world. According to statistics issued by the Fire Protection Bureau and the Ministry of Public Security, in 2001 alone there were 215,863 fires in which there were 2,314 fatalities, 3,752 injuries, and property damage in the amount of 1.39 billion RMB. The Chinese government has taken active measures to solve this, and has allotted over 3.3 billon RMB, for fire safety and prevention measures. All in the form of over 6000 key infrastructure construction projects over the next 5 years. Due to the underdeveloped Chinese domestic fire prevention industry, more than 40% of all fire prevention products are imported. This translates to approximately 13.2 billon RMB available for the importation of foreign fire protection products over the next 5 years.

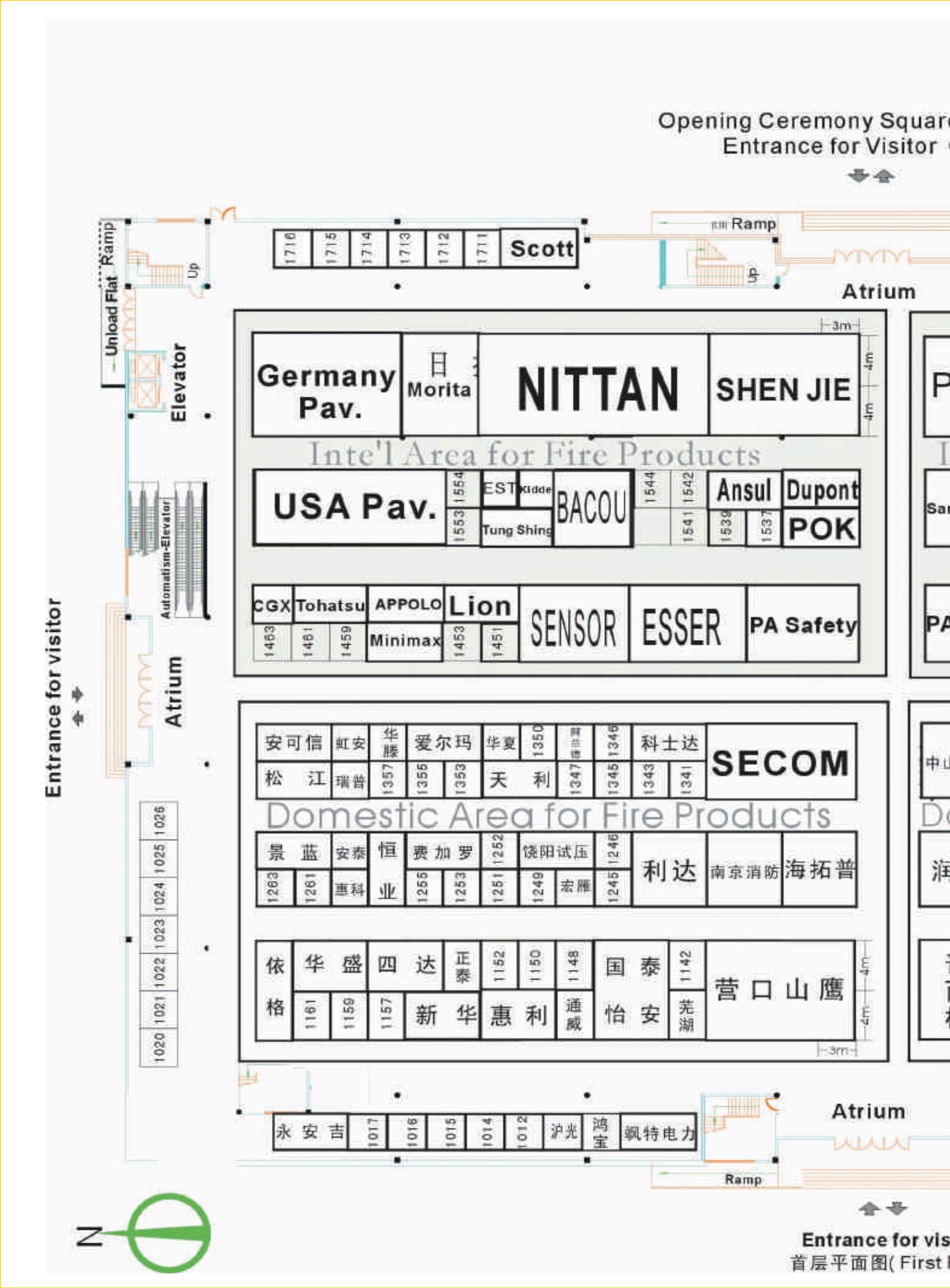
The Largest Exposition in Southern, Eastern & Western China

In cooperation with various urban and provincial fire protection associations, the Fire Protection Bureau, Guangdong Province Public Security Department and the Guangdong Province Fire Prevention Association will present the "2003 Guangdong International Exhibition for Fire Prevention Equipment and Technology" (FIRE GUANGDONG 2003) in Guangzhou, in May 2003. This Exhibition will focus mainly on Southern, Eastern and Western China, and will be the largest exposition in these three areas. Eastern and Southern China are the two most economically developed regions of the country, with the highest concentration of industry; accounting for more than 60% of GDP; while Western China will become another highly developed centre within the next ten years. It is estimated that these three regions will occupy more than 70% of China's total fire prevention expenditures.

This highly anticipated global event is going to cover 900 standard booths spreading over 20,000 square meters. It is predicted that over 100,000 professionals will attend this event, including leading experts in the field of fire prevention, business agents, government officials, fire prevention communities, and many distributors of fire-protection products. Additionally, the international media will be present, reporting the event to all quarters of the world.

Promotion Campaign and Seminars Profile

To promote the FIRE GUANGDONG 2003, a range of internationally well-known manufacturers of fire prevention products will give their demonstrations of fire fighting methods



and technology. This will be a powerful attraction for the media from all over the country. In addition, there will be several professional seminars and public lectures on advanced technology and fire suppression products have already been scheduled. The internationally acknowledged experts will give academic reports and have discussions with all concerned.

Schedule For Site Operation

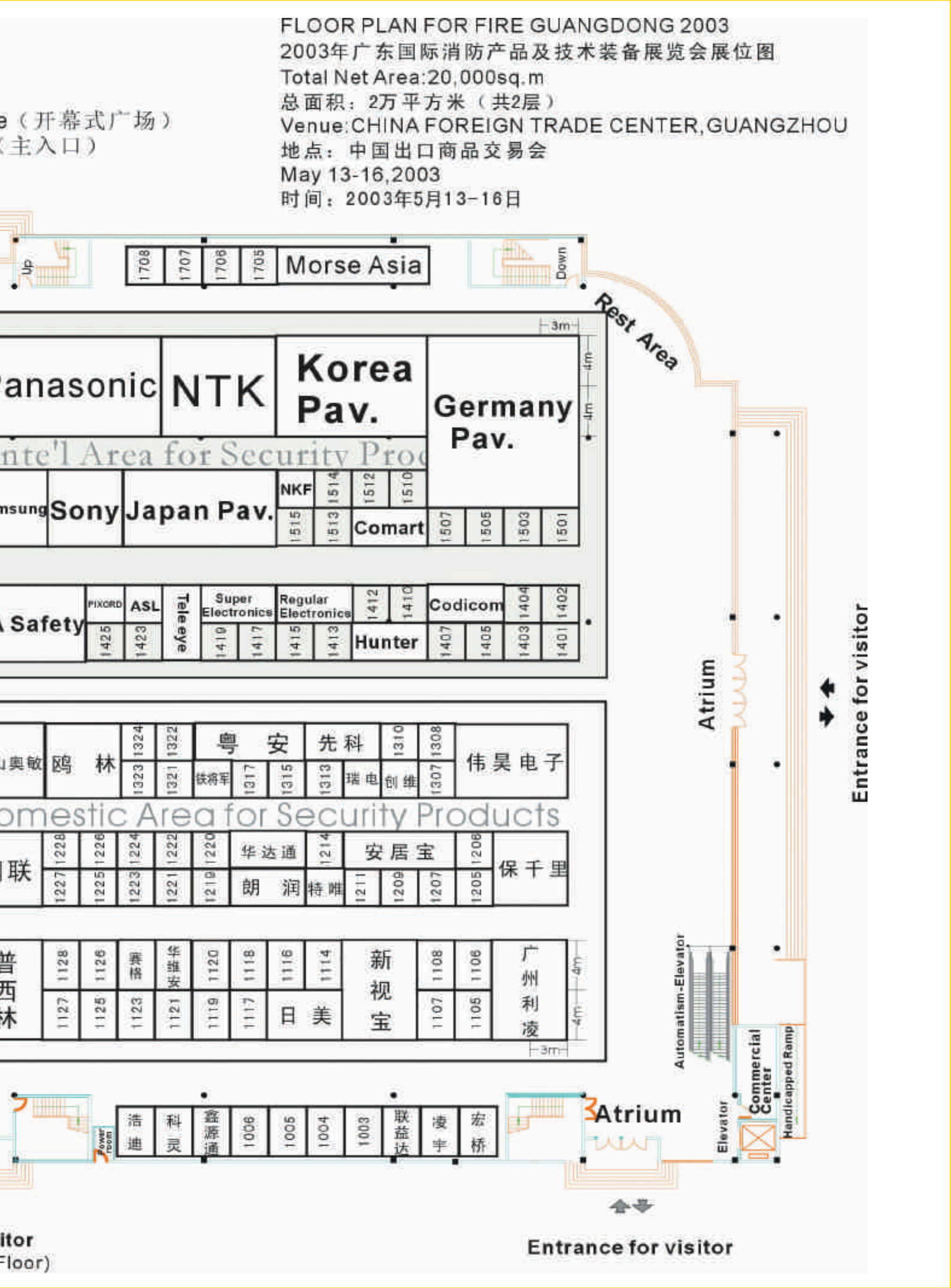
Setting up: May 11-12, 2003
Exhibition Session: May 13-16, 2003
Dismantling: From 3 p.m. to 6 p.m., on May 16, 2003
Open Hours: 9:00 a.m.-4: 30 p.m.

Venue & Total Exhibition Area

Guangzhou, China Foreign Trade Center is one of the most well known exhibition venues in the world, Jinhan Exhibition Center is a part of Foreign Trade Center, where the China Export Commodities Fair is held twice a year which is a grand event in China, the sellers, buyers and visitors from all over the world participate because its famous every year. The total Exhibition Area is 20,000 square meters.

Scope of Exhibition

1. Fire Vehicle, Fire Fighting Plane & Fire Boat
2. Fire Detection & Alarm System
3. Fire Fighting and Rescue Equipment
4. Foam Equipment & Systems
5. Fire Extinguishing equipment
6. Fixed & Mobile Fire Fighting Equipment
7. Fire Hydrant, Hydrant Cabinet, Connection Hose reels & Nozzles
8. Pumps & Valves
9. Materials on Protective Covering, Resistant & Building and Fire Proof Construction
10. Fire Door, Shutter & Access System
11. Effective Extinguishing
12. Fire Prevention & Smoke Evacuation Equipment
13. Disaster Area's Communication & Lighting Equipment
14. Fire Technology & Equipment on Petrochemical, Aviation, Forestry, Water
15. Fireman Personal Protective
16. Fire Engineering Design and Installation
17. Computer Software
18. Magazine About Fire Professional Regulations & Standards



Exhibiting

A. Package Stand 9sq.m (3m×3m)
Unit price: US$2880 per booth
Includes Basic Fittings: Three-meters fascia board with company's name (1); Walls on three sides; Carpet (9 sq.m); Table (1); Chairs (2); Fluorescent Lights (2); 5amp/220v Single Phase Socket (1), Waste Paper Basket (1).

Raw Space
Unit price: US$285 per sq.m (Minimum area of 54 sq.m)

Outdoor Space
Unit price: US$228 per sq.m (Minimum area of 54 sq.m)

Free Services

- Pre-exhibition promotional campaign
- Assistant in traffic and accommodations
- Assistance in visa applications and hotel reservations
- Communication and negotiation with purchasers and suppliers
- Seminars and summit meetings of advanced technology and trade development
- Company and product listings in the official directory
- Assistance in transportation and entry for exhibits.
- Assistance in hiring of interpreters, temporary workers, stand design and printing of promotional literature

Transport Of Exhibits

Appointed Official Overseas Forwarder: Hansen Exhibition Forwarding Ltd.
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Fax: (+852) 2367-0479
E-mail: info@hansenhk.com
Contact: Mr. Michael Kun

Advertising

Free publication of company's brief introduction (Max. 200 words) in the official Exhibition Directory; the organizing committee has the right to delete exceeding parts of the introduction. This advertising enables your products to be introduced to the biggest market in the world. Please send the artwork films before April 13, 2003 to Union Fair & Trade Co., Ltd.

How to Apply

A. The candidate should fill in the Reservation Form completely (in block capitals) and return it to the organizing committee office via post or email, fax due April 13, 2003.

B. Once the completed form is received, the organizing committee will notify the candidate of his/her booth information and mail him/her an Exhibitor' s Manual. Please read through this manual and return the completed form to Union Fair & Trade Co., Ltd.

C. The candidate should pay for the booth fee by T/T to the appointed account.

Registration Forms can be obtained by contacting the office below

Union Fair & Trade Co., Ltd. Guangzhou Office:
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Yuexiu District, Guangzhou, 510030,
P. R. China
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Developing an effective decontamination strategy

**By Tony Hughes – Managing Director,
Hughes Safety Showers Ltd, Stockport, England**

Hughes CUPOLAdecon 2 decontamination unit suitable for treating emergency services and, in smaller incidents, members of the public. Extended sumps can be added for greater versatility

ANY MAJOR INCIDENT is likely to involve several distinct approaches to decontamination.

Treating casualties can range from a relatively small group of employees in a factory to several hundred, or even thousand, members of the public. To the usual hazards associated with industry, we now have to add the potential threat of terrorist action which, could take place anywhere. Recent events suggest that such action could involve large numbers of casualties who could not necessarily be decontaminated effectively using traditional methods.

TYPES OF DECONTAMINATION

As well as the mass decontamination of the general public, provision must be made for decontaminating emergency services personnel, their protective clothing and equipment. This is probably the area with which most people are familiar, but, again, the additional threat of terrorist action may call for a more sophisticated solution.

Where vehicles, large equipment or structural surfaces have to be treated, there is also the need to contain the contaminant, to prevent further spread, as well as neutralizing it. This requires a different approach in terms of chemical agent and delivery system, with the emphasis on portability.

Decontaminating confined spaces and in areas where potentially sensitive electronic equipment may be housed poses its own problems. Deluging such areas with water may be impractical or undesirable and more effective alternatives are now available.

MASS DECONTAMINATION

Development of mass decontamination systems has clearly been intensified in recent years in response to the heightened threat of terrorist action where large numbers of casualties are likely.

The most commonly used systems intended for major incidents are self-contained shelters which can be fully operational within 10 minutes of arriving at an incident and offer a warm, protected environment for high-throughput treatment of walking and stretchered casualties.

Most of these systems facilitate a three-stage decontamination process and the more advanced can be configured to suit different requirements by repositioning or removing internal partitioning. For optimum throughput of up to 300 casualties per hour, a typical unit would consist of five separate sections each divided into three cubicles. This permits a three-stage treatment of de-robe, shower and re-robe.

Most units employ an inflatable frame which supports a removable inner lining with integral sump which collects contaminants for subsequent safe disposal. It is important that the sump is fitted with floor panels to ensure that users are not in contact with the contaminated run off and that they can walk comfortably and safely through the shelter.

Typically, showering takes place in the second cubicle where trigger operated hand-showers are suspended on flexible hoses so that both walking and stretchered casualties can be treated.

As the number of potential contaminants continues to grow, there is a need to develop more sophisticated decontamination processes. Consequently, there is a tendency to incorporate detergent/chemical additive inducing systems into the shower water supply to ensure a more effective decontamination.

Such chemical inducing systems are not new but the latest models offer much greater flexibility and more precise control. Twin inducers, for example, can deliver two detergents/additives simultaneously to one shower outlet or each additive can be directed to separate stages of the decontamination

Pre-decontamination kits meet the safety, security and comfort of casualties awaiting processing

process. For example, the first cubicle, where casualties disrobe, can also be used for initial showering where the additives are used, leaving the second cubicle for water wash down. Alternatively, different additives can be induced into the water supplies in the first and second cubicles, in which case the second cubicle is still used for wash off but the water includes a saline additive supplied from the inducer.

Furthermore, warm water heaters are used to aid the decontamination process as well as avoiding the shock of cold water to the users.

A range of ancillaries are also available to enhance the performance of the units. Depending on the location, electricity supplies may not be accessible or may be disrupted. Portable generators as well as lighting and air heaters will therefore ensure independence.

The most reputable manufacturers of mass decontamination shelters now offer a completely self-contained package which in addition to the hardware ancillaries includes the provision of pre and post decontamination packs for members of the public. These are designed to meet the safety, comfort and security needs of casualties before and after treatment. Available to suit adults, juveniles and infants, they typically include light-weight disposable clothing and footwear, face mask, bio-hazard bag for contaminated clothing and bag for valuables. Some form of identification is also essential for effective and speedy processing of casualties. The simplest option is a numbered wrist band which can correspond with numbers on the bio-hazard and valuables bags.

As an alternative to the inflatable units, trailer mounted versions are available and can be towed to an incident. A variation on this system is the de-mountable pod which can be delivered to the point of use on the back of a truck. The units usually have all the services on board – power, heat and light – and with the exception of a water supply are totally self-sufficient. As with the inflatable shelters, this type of unit is ideally suited to the decontamination of the public, but is not as well suited to the decontamination of suited emergency service personnel.

Decontamination shelters must be flexible enough to accommodate walking and stretchered casualties

EMERGENCY SERVICE PERSONNEL

Decontamination of emergency services personnel must be carried out separately and various methods have evolved over the last 20 years.

The original wash-to-waste principle, where contaminants are discharged directly into the main drainage system, is no longer environmentally acceptable in many situations. It has been largely superseded by the containment method where wash off is collected in a sump and neutralised or treated for safe disposal. Consequently, the majority of the emergency services now use a wash-to-waste Decontamination Shower within an inflated shelter or a specially designed sump. This allows for the containment of the washed off contaminant, with the option of wash-to-waste in cases of major disaster, where speed is of the essence and the environmental risk is regarded as negligible.

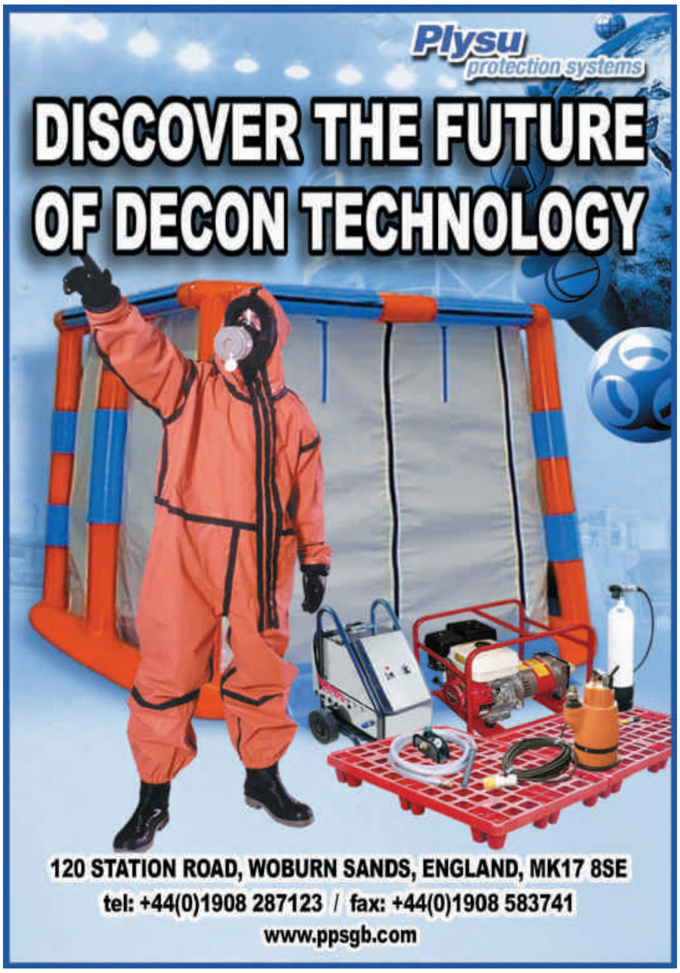
A number of single decontamination units are available which are ideal for use at minor incidents and these have such features as decontamination inducers, disposable linings and sumps and modular design. Some are also adaptable for the storage and decontamination of contaminated equipment.

The most popular development is effectively a scaled down version of the mass decontamination system discussed earlier. In addition to treating protective clothing they can also be used to decontaminate small items of equipment, and at minor incidents they are ideal for the decontamination of small numbers of the general public. Also, in emergencies, they can be used to contain leaking drums until suitable disposal can be arranged.

This multi-role capability has made these units the first choice for the UK emergency services and they are widely used in many other countries. When used at normal chemical incidents, two units can be deployed, one for the general public and one for the emergency services.

Shower heads in these units can be fixed or hand held with the option to

> *The most reputable manufacturers of mass decontamination shelters now offer a completely self-contained package which in addition to the hardware ancillaries includes the provision of pre and post decontamination packs for members of the public.*



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A range of accessories are available to ensure complete independence

attach brushes for more effective cleaning of protective clothing and equipment. Extended sumps are also an increasingly popular feature and consist of an area outside the main shower enclosure where clothing can be removed or equipment treated and where the contaminated wash down can be safely contained.

DECONTAMINATION OF EQUIPMENT

Foam based systems are now being used to decontaminate structural surfaces, large equipment and vehicles. The neutralising chemical is carried in a foam which is sprayed onto the affected area from either a trolley based delivery system or a back-pack unit. The thick, sticky foam produces a blanket which adheres to surfaces and traps the contamination. It immediately suppresses vapour and powder to minimize the risk of dispersal. Foam bubbles have a scouring effect on contaminated surfaces, and a solvent additive improves the penetration and effectiveness of the neutralising agents.

Once decontamination is completed, the neutralised chemicals can be washed from the affected surfaces using a portable jet washer. During this final wash-off stage, there is a further opportunity to add chemicals to complete the process.

MIST TECHNIQUE

Working in confined spaces, such as the inside of vehicles, can pose particular problems especially if equipment is present. The preferred and most effective method is to use an atomised spray. It quickly disperses throughout the treated area and condenses on all surfaces providing uniform coverage without the risk of wetting or excessive exposure associated with normal spray nozzles which could damage equipment.

A dilute neutralising agent is delivered by compressed air, fed from a standard breathing apparatus cylinder, to a hand held ultrasonic spray head where it is atomised into a dense fog, thus having the added advantage of combating airborne contaminants.

The same system can be used to decontaminate the inside of protective suits delivering a fine mist which disperses evenly throughout the suit to ensuring uniform treatment of all internal surfaces. Deodorants can also be introduced as part of the chemical treatment to eliminate any unpleasant odours that may accumulate within the suit.

TOTAL SOLUTION

Recent efforts have been directed towards bringing together the various decontamination systems into a single transportable unit. Compact equipment design, interchangeable components and on-board palletized storage and handling are being used in developing totally self-contained trailer mounted rapid response units to meet the complete range of decontamination requirements.

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Protective Fabrics for

By Johnny Ho

Lenzing FR Viscose *© Hermann Kollinger OÖLFV*

As a result of increasing safety consciousness, the Protective Clothing standards have been revised and upgraded, which are mainly based on the international standards such as European Standard EN 469 and the US Standard NFPA. In order to learn what kind of fabrics is used in fire-fighting clothing, it is necessary to understand the structure of the garments.

Basically, a fire-fighter protective garment, which is also called turnout gear, has four layers, including outer shell, moisture barrier, thermal barrier, and lining. The outer shell provides protection from flame and heat. The moisture barrier, which is next to the shell fabrics, acts as a protector from steam and harmful chemicals. The third layer, which is a needle-punched felt or non-woven fabrics, acts as an insulator against heat conduction. The lining is the inner layer for providing comfort to the wearer. Normally, the lining is quilted with thermal liner. For wildland fire fighting, a single layer protective garment is normally worn over a station uniform.

The basic prerequisite for a fabric to be used in making fire suit must be flame resistant, does not melt or drip. A FR fabric has to extinguish in less than 2 seconds after flame and burn less than 6″ char length according to the ASTM specification D6413 Standard Test Method for Flame Resistance of Textiles (vertical test) or flame spread test EN 532. In NFPA standard, all fabric materials shall have an average char length of not more than 4″.

> DURING THE PAST FORTY YEARS, many flame-retardant fabrics have been developed for use in fire fighting clothing. In fact, the demand for flame resistant (FR) fabrics has increased drastically in the Asia Pacific region due to the following phenomena. The economic advancement has transformed many places in the region into populated and industrialized zones, where countless high-rise buildings have been erected in major cities. In addition, more and more world events are being hosted in the region. This has caused an increase in international travelers and tourists, which in turn has led to more stringent demand in public safety services.

Beside flame resistance, an outer shell fabric has to have certain physical properties with or without external stress such as heat. Those basic safety requirements are residual strength, heat resistance, tensile strength, tear strength, surface wetting and dimensional change.

As required by European Standard EN 469, residual strength has to be equal or greater than 450 Newton (N), which measures the tensile strength of outer shell when having exposure to heat according to EN 366 Method A at 10 kW/m^2.

Any fabric to be used in turnout gear, it is necessary to pass the heat resistance test, where an individual fabric sample is placed in an oven heated to 260°, and the fabric shall not melt, drip or ignite. The shrinkage shall be equal to or less than 5% according to the requirement specified in Annex A of EN 469.

According to the EN 469 Standard, the tensile strength and tear strength of the outer shell fabrics have to be greater than 450 N and 25 N respectively.

Fire-Fighter Clothing

Dimensional change should be within ±3% after 5 cycles of washing with the procedure specified in ISO 5077. For moisture barrier cloth, there shall be no penetration by liquid chemicals to the innermost surface; and 80% of the liquid chemicals shall be running off from the laminated cloth. Moisture barrier is also required to be tested with hydrostatic pressure for NFPA Standard, which shall have a minimum water penetration resistance of not less than 1 psi for 5 minutes and 25 psi when tested according to Method 5516 and Method 5512 respectively as listed in the NFPA standard.

Fibers and yarns are the building blocks for FR fabrics. Fabrics made of treated cotton were widely used in protective clothing before high performance fibers were introduced. Currently, personal protective clothing made of treated cotton fabrics are still used by some countries in wildland and structural fire fighting as well. However, the retardant chemical being coated on the cotton fabrics could be washed away in one wash, if proper detergent is not used.

The advance in technology has allowed us to develop inherent FR fibers in several approaches. First of all, all man-made fibers are made from polymer. The polymer can be made less flammable by both physical and chemical means. In order to change the burning properties of an existing fiber, flame retardant agent is added in the polymer prior to its formation into filaments. The original properties of the fiber will not be changed, which can be polyester, viscose or acrylic.

The second approach is to develop a completely different fiber called High Performance Fibers, with new molecular structure and properties. PBI (Polybenzimidazole), Aramids and Polyamide-imide all fall into this category.

The third approach is to increase the flame resistant property by partially carbonizing the fiber, such as carbonized polyacrylonitrile (PAN).

Each fiber has its own decomposition temperature and combustion or ignition temperature. When temperature reaches a particular ignition point, the fiber will burn. Both heat and oxygen are required for combustion to take place. In order to determine the flammability of a fiber numerically, a testing process known as Oxygen Index Methods has been developed, which measures the minimum oxygen percentage required in order to support combustion of the fiber within a controlled atmosphere. This quantitative value is called limiting oxygen index (LOI), which is commonly reported as a percentage. A textile will burn easily with a LOI less than 21%, since air contains about 20.95% oxygen by volume. Untreated cotton and viscose will burn easily in air since their LOI is about 20%. Most of the man-made FR products have a LOI equal to or greater than 28% such as FR Viscose which has a LOI of 28%.

However, the flame resistant property of a fabric is not solely determined by the LOI of the constituent fiber. The fabric weight, fabric construction and pile or no pile surface all greatly affect a fabric's flame resistant property. The integrity of the fabric after exposure to heat and flame is also important since the fabric may start to decompose before ignition.

There are many FR fibers available in the market with different trade names. The best-known fibers for fire-fighting clothing fabrics in Asia Pacific region are PBI Nomex, Kermel, and Kanox.

> *A testing process known as Oxygen Index Methods has been developed, which measures the minimum oxygen percentage required in order to support combustion of the fiber within a controlled atmosphere.*

PBI Gold.

Pic courtesy of Heinrich Vorndamme OHG

PBI was originally developed for the NASA space program, which is an extraordinary organic fiber. It will not burn in air, emits little or no smoke and does not melt or drip. Even after rapid heating to 400°, tensile strength remains at almost the same level. Unlike other high performance fibers, it has good textile properties. Its elongated cross section is similar to cotton, but it has a moisture regain around 15%, almost 50% higher than that of cotton under the same condition. This moisture regain is at a molecular level. Fabrics do not absorb water at a higher rate than other FR fabrics. And it has outstanding resistance to chemicals, solvents and fuels.

Protective fabrics made of PBI fibers, such as 200 gr/m^2 PBI Gold light weight shell fabrics which are a blend of 40% PBI and 60% high-strength aramid fibers, and exhibit a very high residual strength property which is about 4 times higher as required by EN469 Standard. And PBI Gold retains its softness even in a charred state. The fabric will not shrink and will not become brittle after exposure to flame and heat. This property will provide a better protection from flash over. Due to the high moisture regain of PBI Gold fabrics, PBI fire fighting clothing is comparable to cotton in comfort, which also contributes to excellent static dissipation. Since 1983, PBI has been widely recognized as the premium product in outer shell and hood protection.

Nomex was introduced by DuPont in 1961, which is a registered trademark for DuPont's meta-aramid staple fibers, filament yarns and FR fabrics. Since then it has been used for station wear, coverall and fire fighting clothing. Nomex fiber has excellent thermal stability and does not melt but decompose at 371°. Nomex III, a blend of 95% meta-aramid fibers and 5% high strength para-aramid fiber, offers high strength fabric, which resists most chemicals and acids. Delta T is another product currently found in the Asian market, and is a blend of 75% Nomex, 23% para-aramid and 2% carbon fiber.

Kermel was developed in France by Rhone Poulenc in the 1960s. Before 1984, it was only available to the French armed and police forces. Kermel is made of polyamide-imide and belongs to the same family of meta-aramid. Since Kermel is a smooth-surfaced fiber with an almost circular cross-section, it gives a softer hand when comparing to other aramid fabrics. It also resists chemicals with high resistance to abrasion, and the fabric has a thermal conductivity twice as low as any other fabric made of aramid fiber. It resists up to 250° for a long duration.

A fabric has been developed for higher breaking, tearing and bursting strength by using the Kermel HTA core yarn. The Kermel HTA core yarn is made by wrapping para-aramid yarn with the Kermel fibers in order to increase thermal resistance and strength.

Lion Iso-Dri. Picture courtesy of Lion Apparel

Kanox is a pre-oxidized fiber, which involves a process to partially carbonize the Polyacrylonitrile fiber in order to make it flame resistant. The fiber also resists chemicals, infrared ray, molten metals and with good thermal stability. Kanox is a registered trademark for Taiwan KK Corporation. Carbonized Polyacrylonitrile starts decomposition at 300°, although spontaneous decomposition does not take place until the temperature reaches 550°. Protective clothing made of Polyacrylonitrile fabrics can be exposed to relatively high temperature for a short period of time.

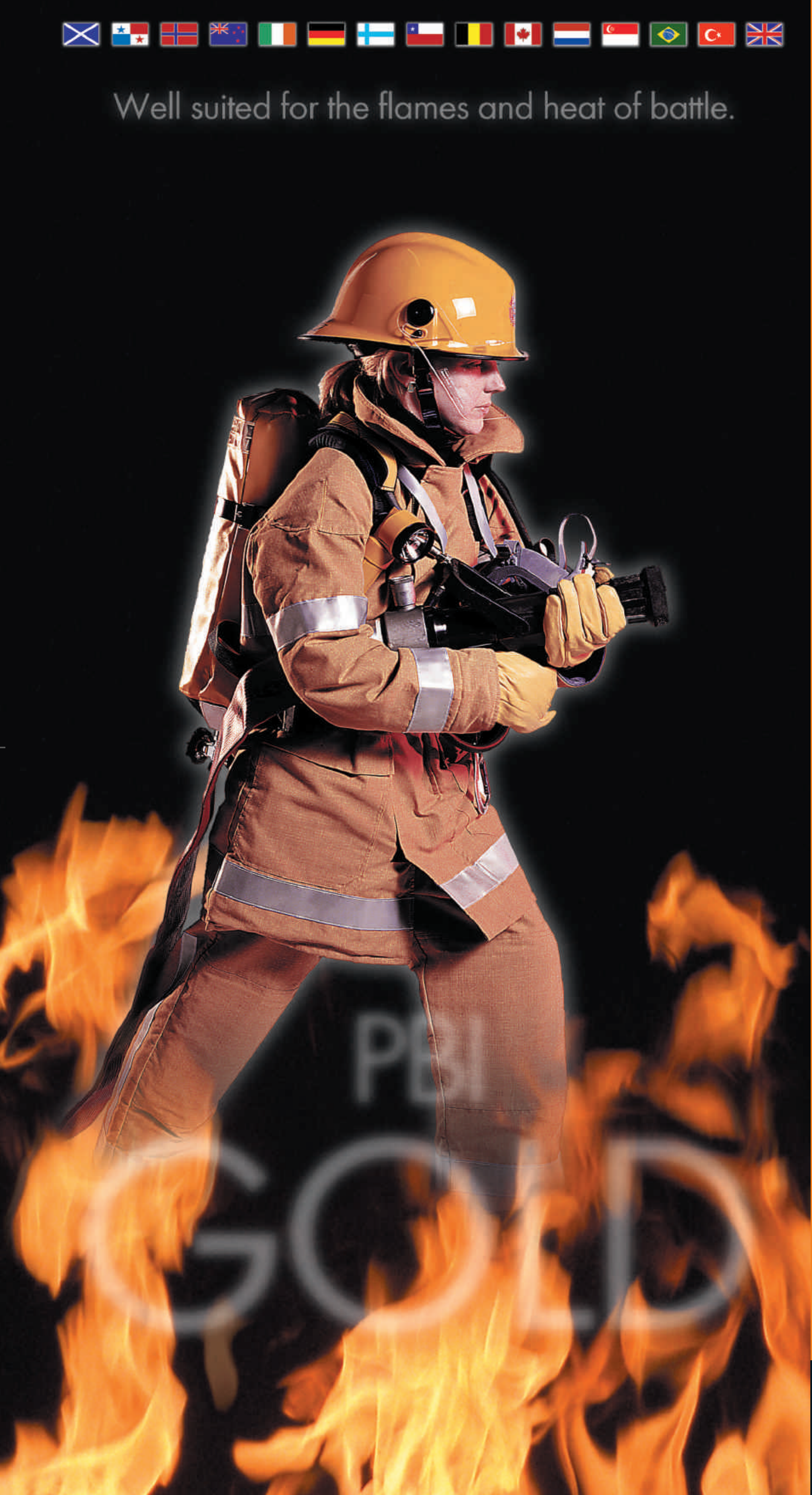
Beside outer shell fabrics, the FR fibers also play an important role in the inner layers of fire fighting clothing. Breathable waterproof membrane is often laminated on non-woven FR fabrics, which are made of FR fibers. Gore-Tex's Fireblocker, Airlock and Crosstech are widely used as moisture barrier in which they are laminated with ePTFE membrane. Gore-Tex has developed a fabric known as Airlock by putting thermally stable and chemical resistant spacers made of foamed silicone on the back of ePTFE membrane, which is a unique combination of thermal protection and moisture barrier. The Gore-Tex Airlock fabric creates an insulating air cushion in order to provide thermal protection. SympaTex also makes moisture barrier with Polyester film, like Crosstech, which is also non-permeable for blood, virus and bacteria.

Lenzing is the major producer of FR Viscose, which normally is blended with Nomex fiber for making lightweight fabrics. The blended fabrics are used as pocketing, facecloth or lining in Protective Clothing.

FR fabric manufacturers are trying to offer more colors in order to meet the specification of the fire brigades in different countries, and fabrics will be finished with new process and technology such as Nanotechnology in order to provide water repellent and durability. There are a lot of FR fabrics that have been developed and are based on the fibers being mentioned in this article in different structure and weave. As the demand of FR fabrics for personal protective clothing keeps on increasing, some Asian countries such as China and South Korea are beginning to develop their own facilities by producing FR fibers or FR fabrics in order to meet their domestic needs.

Kermel was developed in France by Rhone Poulenc in the 1960s. Before 1984, it was only available to the French armed and police forces. Kermel is made of polyamide-imide and belongs to the same family of meta-aramid

In conclusion, there are a variety of fabrics that can be used in fire-fighting clothing, however, safety is the major concern and should not be compromised when choosing for the right fabrics.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COMPRESSED AIR FOAM SYSTEMS AND CLASS A FOAM

Class A Foam and Compressed Air Foam Systems (CAFS) are gaining increasing interest from various UK Fire Brigades as a more efficient and environmentally safe method of fighting most types of combustible material fires including structural fires.

A number of UK Brigades are currently trailing CAFS equipment to assess the key benefits of using Class A foam with CAFS equipment. The main benefits can be summarised as:

- *Quicker knockdown times of fires.*
- *Quicker reduction of heat – cooler environment.*
- *Massively reduce water damage.*
- *Reduced environmental damage.*
- *Less exposure for firefighters to hazards of firefighting.*
- *Simple to use – no special training required.*
- *Reduction in firefighter fatigue due to reduced suppression time and effort.*
- *Less water needed.*

CAFS equipment demonstration

Class A foam concentrate is classified as a synthetic detergent hydrocarbon surfactant and is *similar* to a triple strength dish detergent. Its components reduce water's high surface tension to effectively make water penetrate the crevices found on fuel surfaces. Additionally, it contains foaming agents that create bubbles when the foam solution is agitated with air. The bubbles created keep the water contained within them in contact with vertical surfaces to provide efficient fuel cooling. Class A foam clings to fuels instead of rolling off, preventing the fireground water waste associated with conventional water fire streams.

There will always be financial reservations about investing in relatively new technologies such as Class A foam and CAFS. It is possible decision makers perceive Class A foam concentrate to be expensive and difficult to mix and apply. What may seem intuitively true in theory is not always so in practice.

Today, new technology built into foam proportioning hardware has made Class A foam application easy, accurate and more cost-effective than ever before. The initial investment of acquiring foam concentrate, foam hardware and brigade training must be weighed against the benefits they provide. When costs such as Class A foam concentrate and CAFS hardware can be proven to be cost effective, they are no longer an expense, but rather an investment.

COMPRESSED AIR FOAM SYSTEMS

In a CAFS unit, compressed air is injected into foam solution in the apparatus piping, prior to discharge into the hoseline. Finished foam is discharged into the fire hose or fixed master stream appliance. The features of using CAFS, over using standard branches and foam nozzles to generate finished-foam, include higher quality finished-foam production, lightweight hose lines, increased fire stream discharge distance and finished-foam consistencies that range from “milky” wet to “shaving cream” dry. The benefits for the fire officer are increased flame knockdown capability from a limited water supply, better exposure protection, less fatigue from lightweight CAFS hoses (hoselines are filled with a partial volume of air) and increased foam stream penetration into burning structures to reach the core of the fire.

US Firefighters training with CAFS

The potential of CAFS used with Class A foam offers the ability to deliver large quantities of agent over long distances with the absolute minimum manpower to attack structural fires that previously required massive tactical operations.

CAFS equipment is available from UK-based manufacturers like HALE PRODUCTS EUROPE in a number of different configurations.

Mini-CAFS

A self-contained retro-fittable unit for the compartment of an existing vehicle, typically a small appliance. The Mini-CAFS foam system comprises drive motor, compressor, foam mixing system and regulator, assembled within a rigid frame which fits into the space required for an 8kVA generator. Water is supplied either by vehicle pump or portable pump, without any modification. The foam is supplied either from cans or vehicle foam tank. The equipment is rapidly deployed and easily operated.

Hale Mini-CAFS unit retrofitted to a UK fire appliance

World Series vehicle pump with Integrated CAFS Module

The Godiva World Series pump is the market leader in the UK vehicle mounted pump sector. It is now available with a CAFS unit attached “piggy-back” style to the back of the pump. The system comprises a compressor, Hale FoamMaster V Series foam induction unit and Hale X-mixer system. A solid-state electronic control provides a safety system and full operator control from the pump instrument panel.

Pto-driven Mini-CAFS

This system is essentially the three main components of the self-contained Mini-CAFS unit but supplied as separate parts and installed by the vehicle builder in the required locations (air compressor, foam proportioner and control manifold). This provides installation flexibility and improved maintenance access for the customer.

MCP50 – pto-driven Mini-CAFS components

Further information on CAFS equipment is available from **HALE PRODUCTS EUROPE** on
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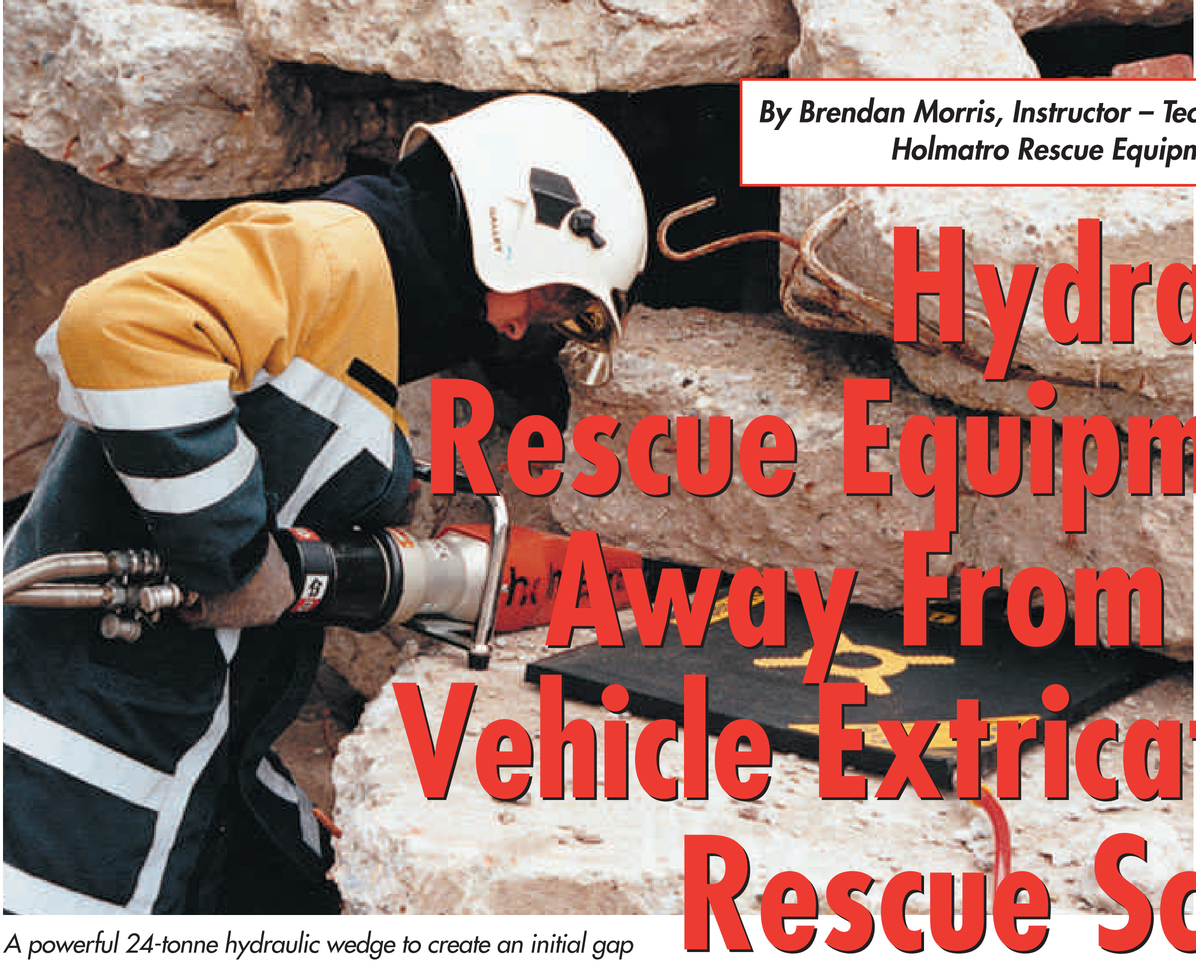
By Brendan Morris, Instructor – Technical Rescue, Holmatro Rescue Equipment

Hydraulic Rescue Equipment Away From The Vehicle Extrication Rescue Scene



A powerful 24-tonne hydraulic wedge to create an initial gap

IN THE EARLY 1970s a gentleman by the name of Mike Brick was hired by a hydraulic tool manufacturer to develop a concept for a hydraulic rescue tool. The rest, as they say, is history. Of course we have come a long way since then, with the most advanced hydraulic tools, making use of high-pressure systems, allowing for low-volume technology that in turn allows for much lighter-weight portable tools as opposed to those big heavy hydraulic monsters of the past. While most double-acting hydraulic rescue tools were originally designed with motor vehicle extrication rescue in mind, now we also see a wide variety of other uses for this equipment in the technical rescue field. Various areas of technical rescue are beginning to make more use of hydraulic technology as the manufacturers begin to develop more holistic rescuer-orientated products. Let's have a closer look at some of these other fields of technical rescue – collapse/urban search and rescue, indoor rescue operations and confined space rescue – and some of the hydraulic tools particularly suitable for use in these rescue areas.

If we begin with collapse search and rescue operations we see an immense use of hydraulics in this field. The main requirement of this application type is portability, considering the often very difficult 'terrain'. Small portable hand-operated combination tools, originally developed with the vehicle rescue in mind, or compact, lightweight, battery-operated combination tools that come with spare batteries that can easily be carried around and swapped, have become valuable pieces of equipment to have in your urban search and rescue equipment cache. In slightly less difficult circumstances where the terrain is not so rough-going, lightweight portable pumps that can power not only combi-tools but also heavier-duty equipment like dedicated spreaders, cutters and rams, are an alternative worth considering. The ability now exists to take the tool into any difficult-to-access place and to use it to cut steel reinforcement in concrete and/or to make strategic lifts for the prying open of confined spaces between rubble. Many of these types of tools were extensively used in the aftermath of 9-11 where it was impossible to lug full hydraulic systems onto the top of the enormous rubble pile for this sort of work.

Of course the use of more heavy-duty hydraulics such as powerful 24-tonne hydraulic wedges used to create lifting bag insertion gaps (starting with a minimum insertion opening only 6 mm) are also used in heavy lift operations successfully. Used in combination with wedges are high-pressure pneumatic lifting bags with their 25 mm insertion requirement that can take over from the wedge. 50-Ton aluminium lifting jacks have been adapted from industrial heavy-duty jacks and in turn can take over from the lifting bags, or if possible be used from the start allow one to make working/entry spaces in the rubble. Modern shoring systems with their integrated pneumatic or hydraulic struts complete this picture. There is an increasing amount of use of this sort of hydraulic gear in heavy lift operations. These lightweight shoring struts with integrated hydraulics make lightweight equipment that can be used to support or lift in heavy lift operations. These operations were not possible in the past without the involvement of heavy-duty industrial equipment being deployed.

When thinking about the use of

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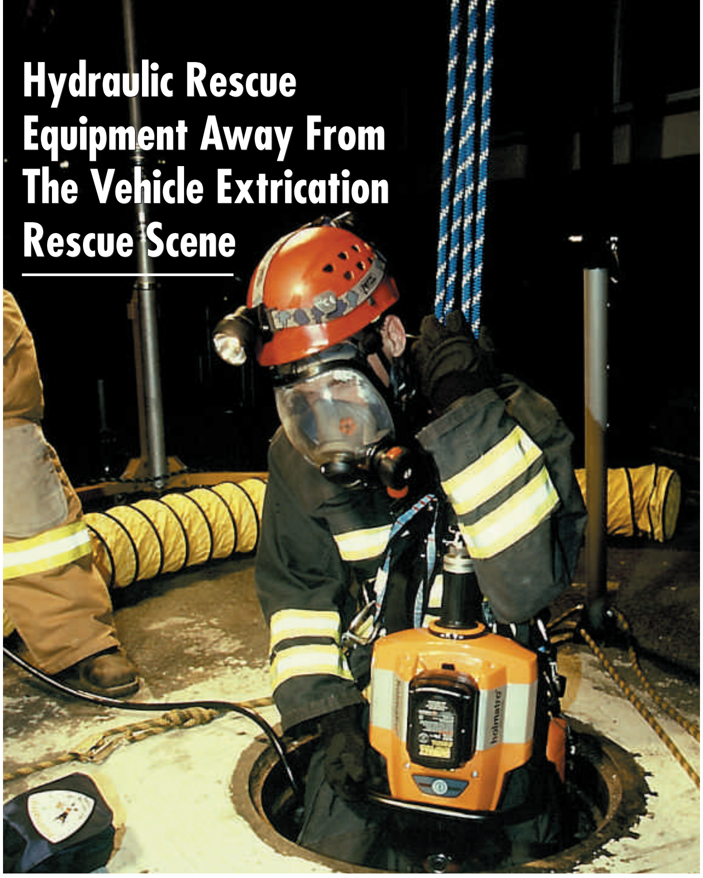
Hydraulic Rescue Equipment Away From The Vehicle Extrication Rescue Scene



Cordless compact battery operated tools offer immense advantages

hydraulics away from the vehicle rescue scene, the second type of rescue one immediately thinks of is certain indoor operations such as elevator rescue. In some cases when an elevator rescuer comes to something more than the routine reconnection of the power, we find that a hydraulic ram and in some cases a spreader are required. In my experience there are however a few things to remember when deploying such tools in indoor environments:

Firstly it is important to think carefully about ventilation of the fumes from your pump if you are using a petrol motor. Remember the CO is a dense heavy gas and generally travels down so watch that it is not moving into the lift shaft and down to your victims. In this case ventilation as well as atmospheric monitoring becomes essential.

Also remember when using a ram to hold an elevator door open not to place it high but to rather opt for the on the

> *In some cases when an elevator rescuer comes to something more than the routine reconnection of the power, we find that a hydraulic ram and in some cases a spreader are required.*

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Hydraulic Rescue Equipment Away From The Vehicle Extrication Rescue Scene

> *Tools may have to be carried through corridors or up (many) flights of stairs.*

ground option even though this may be in the way later. The reason for this is simple. In the unlikely event of the doors moving more open at any time in the rescue the ram may well fall out of place and may even end up careering down the elevator shaft.

Thirdly there is, like in the (urban) search and rescue applications discussed before, the issue of portability of tools. Especially in high-rise or large buildings where power is disconnected and elevators and escalators are out of order, tools may have to be carried through corridors or up (many) flights of stairs. Hand-operated tools, portable pumps with dedicated tools, and last but not least the latest generation of battery-operated tools, unquestionably all have distinct advantages over full-blown rescue sets when rushing to the accident scene.

Lightweight but powerful strong struts create a safe working environment

A third area that has seen the use of hydraulic tools in some cases is confined space rescue. The sequence of tools discussed earlier in this article to gain access or create space – hydraulic power wedge, pneumatic lifting bags with low insertion thickness, lightweight aluminium jacks and shoring systems with integrated pneumatics or hydraulics – very much applies to this application type as well. Needless to say, considering the often very limited space and often the impossibility for more than one rescuer to gain access at the same time, combination tools rather than dedicated spreaders or cutters are often the way to go.

Remember also that no cutting tool is intrinsically safe, in the sense of explosion proof, as it makes use of moving metal blades over one another. Therefore the necessary protections against sparks should always be followed when working in an explosive environment. The other thing to consider is again ventilation when using petrol run pumps in these types of confined space environments. Very often a battery-operated self-contained tool is the way to go as mentioned above. Alternatively be sure that good ventilation is in place. If you opt for carrying the battery tool for these cases, be sure to have a good understanding of the battery technology available to you. There is nothing worse than carrying the weight of a dead battery around with you on a rescue scene. A battery tool with a flat battery that cannot be quickly swapped for a fresh battery is not ideal in any situation. It is essential that battery tools have the ability to change batteries and that charging of the battery does not require the whole tool to be out of action.

Of course there are always those “special” situations were hydraulics have to be deployed. These are normally the types of cases that make a good

> *Remember also that no cutting tool is intrinsically safe, in the sense of explosion proof, as it makes use of moving metal blades over one another.*

story back at the station. For instance the boy trapped by his head between the bars of a fence, or the man trapped by his head between the metal poles in the headboard of his bed. After copious amounts of soap and other lubricants fail to assist his extrication one eventually resorts to the hydraulics. When asked how they get into these situations we all know that our patients are not going to have a clear answer.

Whether it is used on the top of a rubble pile in an urban search and rescue application, under the water or down a confined space, what is essential to remember is that while these various situations are not an extrication scene, it is still important to adopt the standard safety procedures regarding the handling of hydraulic rescue equipment in these types of special situations. We should not forget to use the tools safely no matter where or by whom they are being used. This is fundamental to the effectiveness and successful use of this equipment.

Compact mobile equipment can be used for indoor rescue operations

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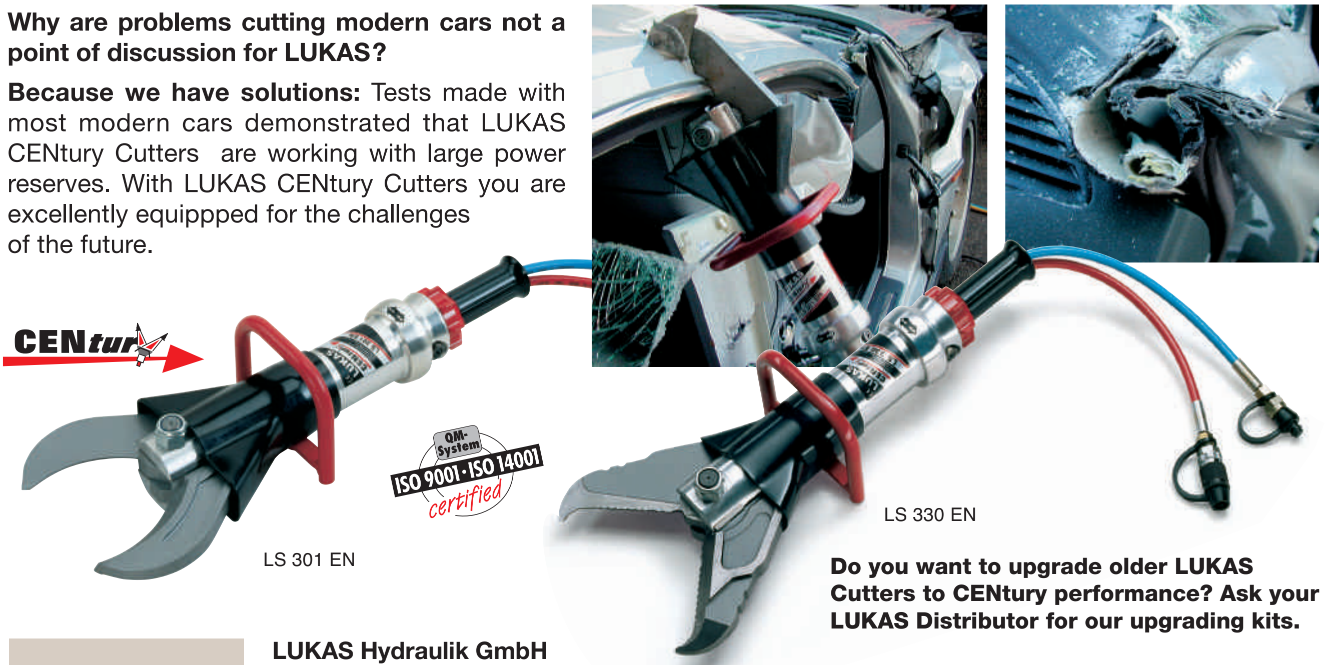

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The replacement of Halon

THE PAST TEN YEARS have seen a dramatic change in the systems used for the protection of high-value risks from fire. Many new types of products, agents and fire protection systems have appeared on the market to provide solutions for different hazards, many claiming to be the all-encompassing solution to meet the replacement of Halon. However, these alternatives are known to have limitations, and it is important that customers are aware of these limitations in order to help them make the right choice.

By Wendy Lee, Technical Director of Tyco Fire & Security Services Asia

Pic courtesy of Tyco Fire & Security Services Asia

THE GOOD OLD DAYS

Some twenty years ago fire protection was simple and lucrative. Most fire protection companies needed only a few products to meet a customer's requirements. These included sprinkler systems for normal commercial risks, and halon for most high value risks. Halon was an effective agent that was also cheap, easy to design, clean and simple to install. It was such a good solution that many companies sprung up just to offer this single source solution.

With the discovery of the effects of halogens on the ozone layer and subsequent requirements of the Montreal Protocol, all this started coming to an end in the late 1980's. Government regulations prohibited the manufacturing, selling and installation of Halon systems due to its dramatic contribution to ozone depletion. Alternatives were necessary, as customers demanded new systems that offered the same performance in terms of fire extinguishing capability.

While all Governments agreed to phase out Halon, not all agreed on the timing of the phase-out. They were faced with difficult decisions on the cost and impact of switching to untried and untested alternative fire protection systems.

Today most countries in the Asia Pacific region have introduced policies to stop new systems from being installed and existing Halon systems from being refilled. However this is not consistent across the region.

Australia, New Zealand, Singapore, Malaysia and many other countries in Asia saw the phase-out of new system installations many years ago, with varying policies regarding the replacement of existing systems. These policies depend on individual Government regulations and funding. Today, some of the only Halon installations are permitted only upon approval from necessary government bodies, meeting the essential use-criteria.

In Japan, the installation of new systems was phased out 8 years ago and the replacement of existing systems is only allowed until the current Halon bank is depleted. As the price of Halon has increased due to the limited and controlled supply, some companies have already started switching to alternative systems.

Korea and China have similar polices to phase-out Halon production by 2010, with no current policy regarding the phase-out of its supply. However, China has already seen a move in the market to stop supplying the gas, while there is a chance that production in Korea may cease before 2010, depending on local demand.

THE ALTERNATIVES

It was soon discovered that replacing Halon was complex because no single solution could offer all of its benefits, simplicity or cost savings.

The replacement of Halon

> *Water mist has evolved over the last few years to provide an effective solution to many types of risks where the use of small amounts of water is not a concern.*

Today many new systems have survived the close examination and testing of the last 15 years to take their place as acceptable alternatives. Each has proven its worth in meeting modern requirements for clean and effective fire protection systems.

Many halocarbon-based agents were developed following the discovery of the impact of Halon on the ozone layer. They all offered effective fire extinguishing capability, but many had drawbacks in terms of cost and environmental effects, among other factors. Today the main surviving halocarbon agent is FM200, which offers benefits similar to Halon. This system requires lower concentrations, and therefore uses fewer cylinders than other available alternatives. However the controlled source of supply plus the by-products of combustion are of concern to both the health of occupants and to sensitive equipment, limiting FM200's use to certain areas only.

Inert gases are environmentally safe and clean agents, combined with unmatched safety for people. These Inert gases consist of natural gases such as Nitrogen and Argon, which exist in the air that we breathe. They provide a very low cost of gas agent and are readily available everywhere in the world. One of the best available agents in this category is INERGEN. INERGEN is a special blend of Nitrogen and Argon with the addition of a small amount of Carbon Dioxide. It was developed specifically to provide fire protection for sensitive electrical and electronic instruments and equipment. It has been proven to be safe for people, for property and for the environment; helping with the growing environmental and safety concerns of many businesses today.

Water mist has evolved over the last few years to provide an effective solution to many types of risks where the use of small amounts of water is not a concern. It is especially effective on highly flammable risks, where the energy of the fire is used to convert the water drops into water vapour. These systems require more extensive engineering and installation cost in some instances, and have a strong presence in the marine market.

Pic courtesy of Tyco Fire & Security Services Asia

BUYER BEWARE

To ensure that the best system is provided, customers need to make sure that the fire systems are appropriate for the identified risks and properly designed. This does not just mean taking into account the systems' ability to extinguish fires, but also how they are used and maintained.

When many of the older Halon systems were being replaced, it was found that some had not been correctly designed and installed. Critical factors that could affect the performance of the system, such as vents, automatic opening and closing of doors, and integration with the detection and alarm systems, were not taken into consideration. System maintenance is also an important integrated part of the system and changes in building occupancy and free space may result in having to upgrade the system.

The search for the ideal Halon substitute has seen positive progress and development, resulting in a wider selection of fire systems. As such, it is important that fire protection professionals with the necessary expertise and knowledge are engaged to ensure that the right systems are in place to meet each user's unique requirements.

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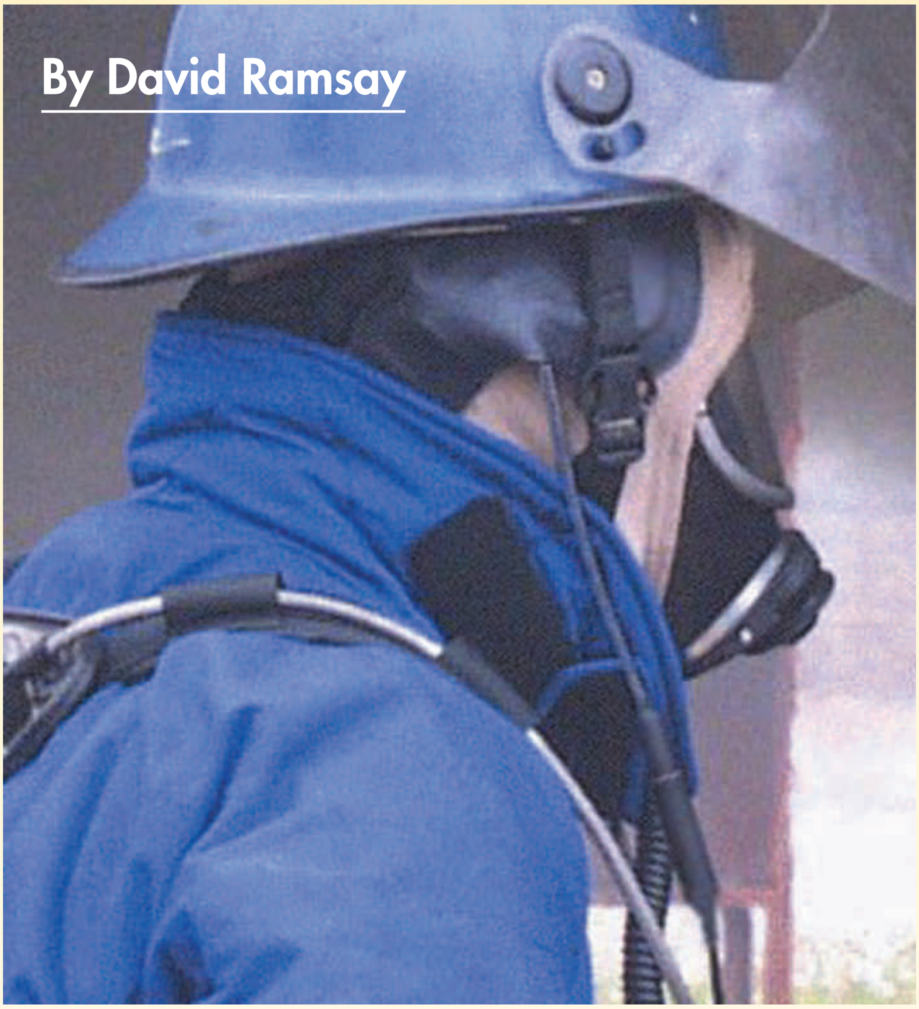
Don't Tell Me You Can't

By David Ramsay



Helmet mounted communications in use with breathing apparatus

THE IMPORTANCE of clear, understandable communications in incident management cannot be over emphasised, not just from a command and control perspective but, even more importantly, from one of safety.

Incident ground operations rely on good communication. Indeed communication can mean the difference between a successful outcome and tragedy. Much has been spoken and written about the fire ground communications issues on September 11 2001. It is not for me to comment on these but one can only speculate whether the tragedy would have been lessened if communications systems had not been destroyed and had performed as they were designed to.

How often have you found yourself either unable to hear instructions, unable to give instructions, or worse still unable to get help because your communications equipment is Either inadequate for the environment in which you are working or fails to perform at critical moments.

Modern technology has brought with it many new types of radio system, along with specialised accessories for fire ground use. Is this progress or have we developed a reliance on complex technology, which is not in the best interests of reliable fire ground communications?

We must be careful that we do not embody new technology for technology's sake, without understanding the limitations of that technology.

Many fire brigades and other services, particularly in the USA, have adopted digital trunked radio as their communications medium. Whilst trunked systems provide wide area coverage, interoperability with other services, and efficient use of radio spectrum, I believe the complex infrastructure associated with them makes them quite unsuitable for fireground use.

Recent events in a number of US cities have highlighted the often tragic consequences of failure of a critical part of a trunked radio network. In one instance a blown fuse caused total loss of communication at a serious fire almost resulting in tragedy.

After twenty-five years of professional involvement in fire brigade communications I am a firm believer in the "kiss" principle – keep it simple, stupid!

In the vast majority of incidents attended by a fire brigade, adequate incident ground communication can be achieved by the use of one or more simplex radio channels. At larger incidents where simplex communication is not possible, either due to the size of the fireground or the size and construction of the buildings involved, the use of local repeaters becomes necessary. In many cases these form part of the building in question and although providing reliable communications for most incidents, they may well fail or be destroyed during a major incident. The World Trade Centre provides a prime example.

It is therefore desirable that such systems be backed up by mobile repeater systems operated by the fire brigade, systems over which the fire brigade has

> *It is therefore desirable that such systems be backed up by mobile repeater systems operated by the fire brigade, systems over which the fire brigade has total control.*

Hear On The Fireground

Repeaters in command vehicles give the fire brigade total control of the equipment

total control. These may be located in command vehicles or they may be dedicated portable units, which can be appropriately located as required.

Trunked radio may provide solutions in other areas, but I do not believe that it is the appropriate technology for use on the fire-ground.

In addition to requiring a totally reliable infrastructure, the emergency incident ground provides a number of unique challenges to test any communications system.

In structural fire-fighting there is the need to communicate in high noise levels or when wearing breathing apparatus.

In rural fire-fighting noise levels may be even higher when helicopter operations or tree felling are being carried out.

At Hazmat incidents communication issues are compounded by the need to communicate from within fully encapsulated suits and in hazardous atmospheres.

At USAR incidents the use of radio may not be possible and the use of hard-wired systems may be necessary.

In such conditions, there is a requirement for specialised accessories to be used in conjunction with portable radio or hard line equipment. These accessories come in four main formats:

- In ear microphones and receivers
- In mask microphones and speakers
- In helmet microphones and accessories
- Throat microphones

In ear microphones have come a long way since the relatively crude devices, which were available in the early 1990's. Early devices were very susceptible to background noise and were quite unsuitable for the fire-fighting environment. High quality ear microphones are now available, however, any ear worn device is susceptible to hygiene and consequent health and safety problems in the dirty environment encountered when one is involved in hot fire-fighting. They are more suited to Police and security operations than fire-fighting.

In mask devices provide communication for a fire-fighter wearing breathing apparatus, however many of the devices available do not adequately reject background noise. Although offering a significant improvement over speaking into a handheld microphone through a voice diaphragm, they only provide part of the answer. Speech quality is affected by the fact that the user's mouth is obstructed by the mask. They are also restricted by the fact that they are only of use when the user is wearing a mask.

Helmet based systems can provide useful communication whether or not the user is wearing a mask. There is however the need for the user to be wearing a helmet.

The majority of helmet systems use a bone conduction pickup mounted within or on the headband of the helmet. Whilst bone conduction pickups have been available for many years, until recently the quality of sound has been less than acceptable and they have acquired a reputation for poor speech quality.

Modern bone conduction devices, properly interfaced to portable radios or hard-wired communication systems, can provide highly intelligible speech transmission with minimal pickup of background noise. Because they do not rely on speech from the user's mouth, the use of a breathing apparatus mask has little effect on speech quality.

These devices are useable in ambient noise levels of up to 120dB, making them ideal in the high noise environments referred to above. Using these devices, clear intelligible radio communication is now possible in environments where face-to-face communication is impossible.

Throat microphones provide an alternative to bone conduction pickups. They can provide a similar level of ambient noise rejection and have the advantage that the user does not need to be wearing a helmet.

Modern technology has provided us with a number of options, some useful, some not. With adequate planning and the use of appropriate equipment, don't tell me you can't hear on the fire ground!

David Ramsay is Managing Director of Audio Communications Ltd. Based in Auckland, New Zealand, he has been professionally involved in fire brigade communications since the early 1980's. During this time he also served for 21 years as an officer in the Auckland Volunteer Fire Police Unit. Alongside his engineering expertise, this operational experience has proven invaluable in understanding the requirements of emergency service communications systems and equipment.

In structural fire-fighting there is the need to communicate in high noise levels or when wearing breathing apparatus

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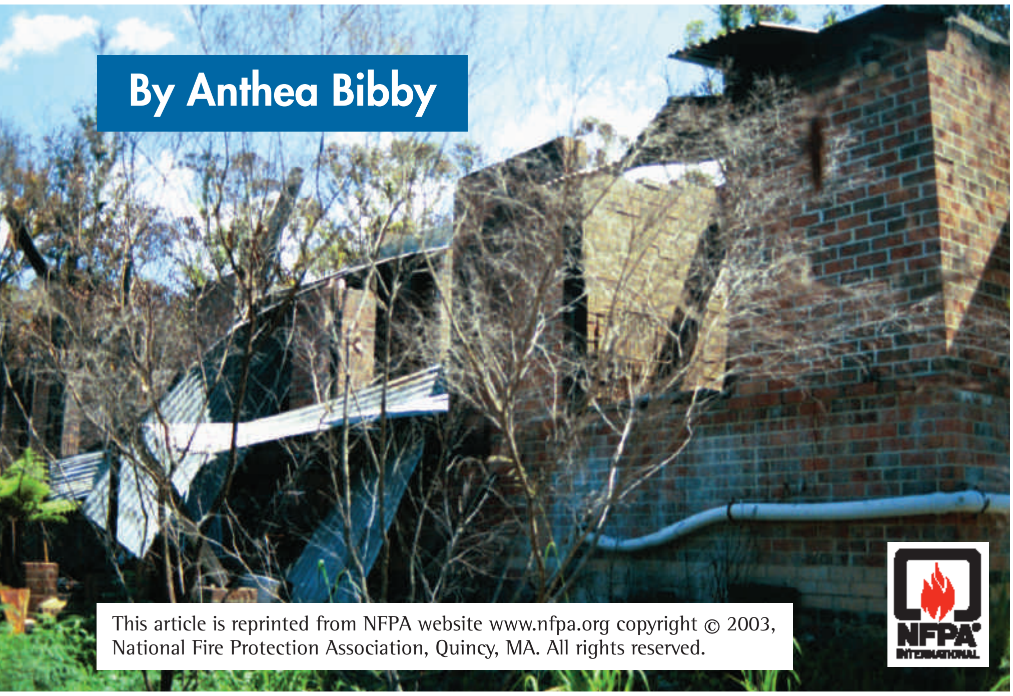
Working Towards

By Anthea Bibby



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Australian officials look for ways to reduce the wildfire burden as they face yet another record season.

As bushfires approached the rural community of Uriarra, 9 miles (15 kilometers) northwest of Canberra, Australia, on the morning of January 18, police told residents that they could stay or go as they saw fit. Everyone decided to stay put.

That afternoon, police received a frantic call to evacuate the village, but by that time, the raging fires prevented anyone from getting through by air or road.

The scene played itself out again in the western Canberra suburbs of Duffy and Chapman, where many residents decided to defend their homes, too. They turned on their lawn sprinklers, blocked and filled their gutters with water, and wet down their roofs and fences.

When police decided that afternoon to evacuate Duffy and Chapman, it was too late. Thirty homes were already burning.[1]

Eventually, the firestorm consumed more than 400 homes in the western suburbs of Australia's capital city and killed four people.

As Australia continues to battle one of its worst bushfire seasons in its history, the importance of community awareness of the consequences of saving property at the possible expense of lives takes on a sharp focus.

"Never before has the importance of community involvement and preparedness been more obvious," says Alan Rhodes, chair of the Australasian Fire Authorities Council's (AFAC) Community Education Group.

CHANGING PATTERNS

Australia is a large, geographically and culturally diverse country with a relatively small population. It's also one of the most wildfire-prone countries in the world.

From the 1930s through the 1980s, the pattern of wildfires in Australia suggests that parts of the country could expect to contend with a particularly bad fire season about once each decade, says Russell Taylor, manager of Community Education for the New South Wales Rural Fire Service. In the 1990s, however, this pattern began to change in some parts of the continent.

New South Wales, for example, experienced several devastating wildfire seasons in the last 10 years, with very little let-up since 1994. The 2002 to 2003 wildfire season began in mid-September, the first month of spring. By mid-November, firefighters had already responded to more than 200 significant fires that killed one civilian and caused significant property damage. Surprisingly, some of these fires occurred in the tropical rainforests of the north coast, areas not normally prone to wildfires. And all of this took place before summer had even begun.

Fortunately, Australia does have certain advantages when it comes to dealing with wildfires. With only 22 fire service groups covering the whole country, national coordination, information dissemination, and cooperation are easily achieved, and the AFAC is ideally positioned to act as a resource for the country's fire and emergency services and land management agencies.

Another advantage is the country's political structure, which allows making, planning, and implementing public policy to take place statewide, rather than regionally. This helps Australian communities avoid "reinventing the wheel," leads to economies of scale, and facilitates a consistent countrywide approach to dealing with unwanted fire.

Although a well-coordinated system of cooperation among the Australian states during wildfires is well established, problems arise when each state is facing its own harsh wildfire season, as is the case this year.

So why is this season so different? And why is Australia's general fire risk so much greater than it has been?

CLIMATE CONDITIONS AND DEMOGRAPHICS

The main source of the wildfire problem is the El Niño weather pattern, which has brought lower-than-average rainfall and higher-than-average temperatures. Large parts of Australia are suffering the effects of long-term drought. Areas of Western Australia and New South Wales have experienced the lowest rainfall in recorded history.[2] Southwest Western Australia has had its third consecutive low-rainfall winter, and almost all of Victoria and South Australia have had below- to very-much-below-average rainfall. In fact, the situation has gotten so bad that some towns have to truck in their drinking water.

The drought also leaves firefighters at a loss for water for firefighting purposes. In some areas, reticulated supplies, as well as dams and rivers, are significantly depleted or virtually non-existent.

Community Safety

The severe drought, together with increased fuel loads in the very dry woodlands, points to a much greater level of wildfire risk for the 2002 to 2003 fire season.

Another factor is Australia's population concentration. Most of the country's 20 million people live along the eastern and southeastern coasts, where rainfall levels have been well below average.

In addition, the urban–rural interface is expanding, prompted by a lack of space, increased inner-city housing prices, and the appeal of living in a natural environment. Urban sprawl once went hand-in-hand with massive clearing of bush, but this is no longer the case. More communities are being built in or on the edge of the bush, and many of the people moving to these areas don't realize the dangers associated with their environment. Nor do they understand their responsibilities in terms of protecting their homes and assets.

Further complicating the situation in coastal districts is the transient tourist population. Many tourists don't know the areas well, don't have a stake in the community, and don't understand the risks associated with the area, which is often dotted with holiday "shacks" hidden amongst the bushland.

A PARTNERSHIP IN PROTECTION

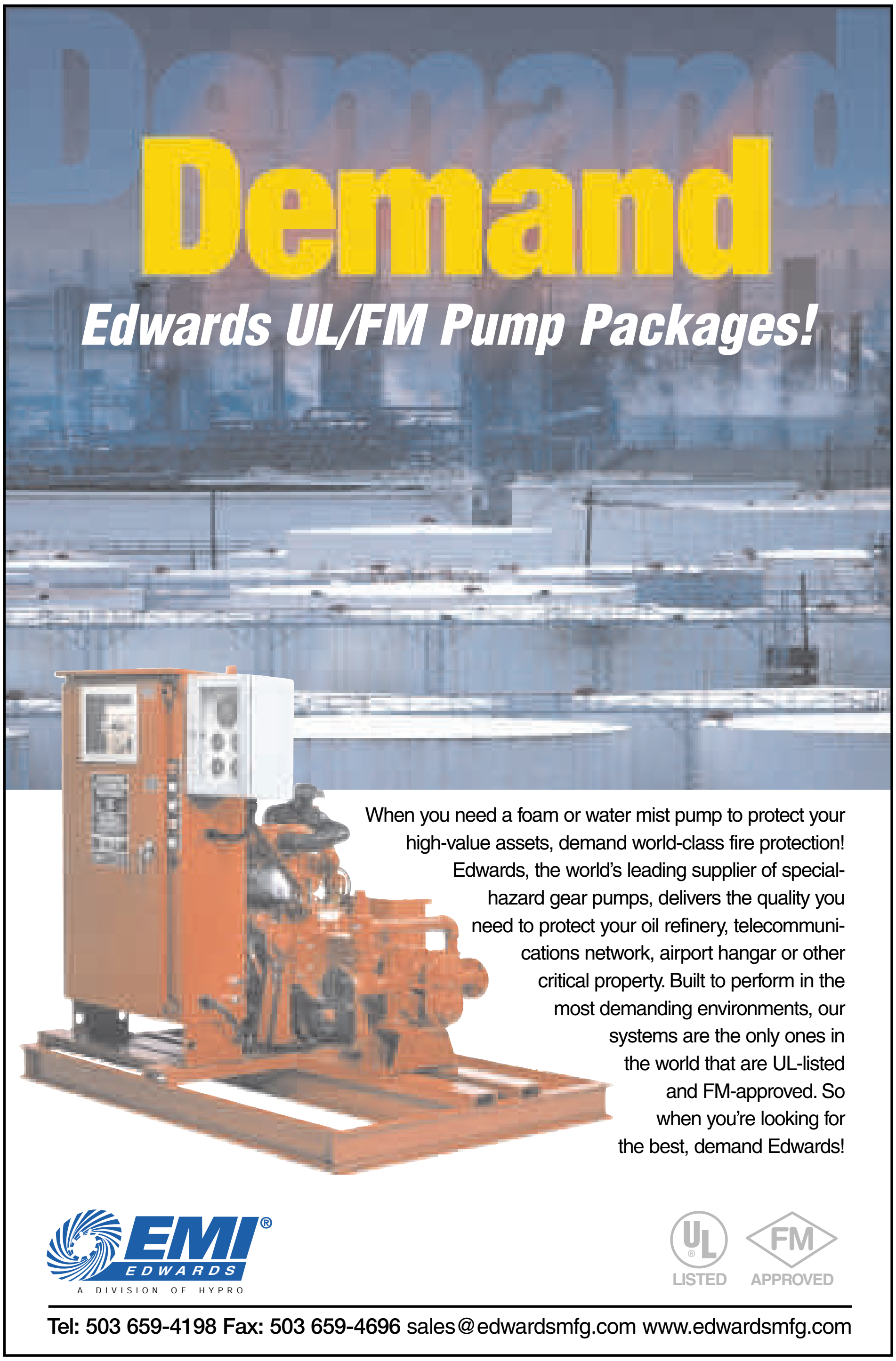
Against this background, it's clear that keeping Australian communities safe from wildfire requires a close partnership between the fire services and the communities they protect.

Most Australian firefighters are volunteers, and local farmers predominantly staff many rural brigades. The prolonged and intense fire seasons place extraordinary demands on them at a time when they are already stretched to the limit by the stresses of the oppressive, long-term drought. Even with the most modern training, the latest equipment, and the strongest willpower, it's impossible for fire services alone to provide adequate protection from wildfire.

As a result, the Australian fire services' overall aim is cooperating with their communities to help them identify their risks, know their responsibilities, assess their needs, understand how fire in their area is likely to behave, and have practical plans in place to deal with disaster when it strikes. The key to achieving all this is education.

While there are a variety of approaches and programs throughout Australia, community wildfire preparedness education basically falls into two categories: general public awareness campaigns and targeted, community- and street-level programs.

General public awareness campaigns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include media campaigns, public meetings, and programs, such as “Bushfire Blitz” and “Western Australia’s Bushfire Ready,” in which officials use a variety of media to disseminate information about prevention and preparedness among high-risk groups.

The more targeted community-level programs, such as Victoria’s Community Fireguard Program, launched in 1993, are designed to help participants become self-sufficient. Based on the belief that a well-prepared house gives firefighters an advantage in protecting it from a passing fire and serves as the best refuge for residents during a fire, they recommend that able-bodied people stay and help defend their properties, but only when they’re properly prepared.[3] To that end, the programs provide on-going training to help residents identify and assess their risks, decide whether to evacuate early or stay to defend their property, and plan and prepare for fire. They also ensure that residents are sufficiently organized to undertake individual or group action during a fire.

Among the information community educational programs provide are the main causes of fire death; appropriate construction in wildfire-prone areas, factors affecting wildfire behavior, and how to create buffer zones. Other topics include planting to minimize the impact of fire, fuel reduction, care of pets during a fire, fire protection equipment, and survival plans. Educators also discuss the upcoming weather patterns and fire risks.

Another key part of planning and preparedness that the programs address is safe access and egress for fire service vehicles. The urban/wildland interface in Australia is renowned for narrow roads with limited turning circles and many dead ends. Therefore, safe access and egress for fire service vehicles is. Such roads also become an issue during the evacuation of residents.

No matter who they are tailored to, all of these programs are predicated on strong community involvement in, and ownership of, the process. To be effective, the whole community – fire services, land management agencies, industry, local government, and residents – must participate in identifying risks and assessing the need for mitigation.

While news reports from Victoria’s fire-threatened Alpine areas in January painted a frightening picture of a massive firefront hundreds of kilometers long bearing down on several towns, they also showed well-organized, confident communities with fire plans in place, working in partnership with fire service personnel.

A nationwide assessment is yet to take place of the success of community programs in mitigating the effects of this season’s wildfires. However, it is clear that “where programs similar to the U.S. Firewise have been fully integrated in the prevention strategy over a period of years, the community has been empowered to actively prepare for fire and to stay and protect their homes, and, in most cases, property losses have been kept to a minimum,” according to K. Thompson, chair of the AFAC Community Safety Committee.

> *No matter what the aims or audience of a community wildfire education program, ensuring the quality of the information being imparted is an on-going issue.*

FIREWISE

Although the Australian approach to evacuation seems to be different than that of the United States, the U.S. Firewise Communities program reflects many of the central aims of the Australian community educational programs and dispenses some of the same advice. One particular area in which the U.S. program has a great deal to offer is its approach to educating and partnering with officials and experts, advising them on fire intensity, risk, land use, and vegetation type.

For this reason, AFAC, in conjunction with NFPA, is assessing the applicability of Firewise in Australia, especially in terms of its use in educating and briefing town planners, building regulators, and local government officials. The Firewise model also helps when it comes to consulting with environmentalists, residents, advocates of alternative lifestyles, and developers.

No matter what the aims or audience of a community wildfire education program, ensuring the quality of the information being imparted is an on-going issue. If wildfire preparedness education is to be effective, it must be practical, targeted, and adaptable to a variety of communities. It must also be evaluated and updated constantly.

A decision to implement Firewise in Australia is not expected before October.

As with all such projects and programs, the one underpinning aim of Australia’s community education programs is to enable communities to develop the best possible protection from the effects of wildfire.

THE ROLE OF AFAC

AFAC, a representative body for fire and emergency services and land management agencies in the Australasian region, was established in 1993 and has 24 full members. There are also 10 associate members, including the New Zealand; Papua, New Guinea; Singapore; and Hong Kong fire services. AFAC plays a key role in coordinating the cooperation of fire services and land management agencies throughout Australia and New Zealand. In addition, it’s crucial to ensuring that the public, government, and bureaucracies, and those advising all these people, have access to appropriate, accurate, and up-to-date information.

Those who develop, deliver, and facilitate community education programs must be able to supply sound advice to communities and individuals with particular needs, understand the implications of legislative changes, and be aware of the expectations and likely support available from local fire services. At the same time, they must be able to

Crucial to the process of maintaining a flow of quality data to all stakeholders are AFAC's efforts in obtaining federal funding to set up a national Cooperative Research Center (CRC).

relate to people from different cultural backgrounds and to understand how people learn, how they are likely to behave in a wildfire, and what motivates them to take action.

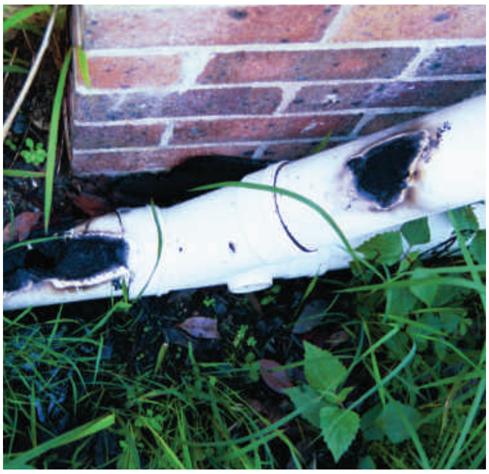
A recent example of AFAC's contribution in this area is a study of the community response to the 2001 to 2002 wildfires in New South Wales, which highlighted the importance of people's perception of risk in their approach to fire preparedness and their motivation to act.[4] The study also "identifies the need for on-going research to underpin policy positions and continued efforts to engage communities in developing their understanding of the [wildfire] risk and their capacity to respond effectively to the risk."[5] The still-unreleased report's insights will be invaluable to those who develop, deliver, and evaluate community safety programs.

AFAC is also facilitating the identification and development of competencies relating to community safety, community education, and liaison. In addition, it's involved in developing models for community education and a framework for evaluating these programs.

Crucial to the process of maintaining a flow of quality data to all stakeholders are AFAC's efforts in obtaining federal funding to set up a national Cooperative Research Center (CRC). The recently announced CRC involves a wide range of partners, including the Commonwealth Scientific Industrial Research Organisation (CSIRO), universities across Australia, the Australian Building Codes Board, and Australian fire services. It represents Australia's new approach to fire research and will become the focal point for research into urban/wildland interface fires.

The CRC would undertake a variety of wildfire-related research projects based on national priorities. Areas likely to be tackled are predictive models of wildfire behavior in the urban/wildland interface; building construction; suppression and prevention methods; human behavior during emergencies; and fuel reduction.

Establishing the CRC will mean better coordination of research and allow new developments to be tested in a wide range of Australian environments.



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The system, which is completely self-contained, is designed for rapid deployment and high throughput. It can be easily transported to the site of an incident and operational within seven minutes. The system is based on the company's CUPOLAdecon5 mass decontamination unit, a robust inflatable shelter that is already approved and used by emergency services in many countries. Zipped doors and internal partitions ensure privacy and protection for casualties as they progress through the decontamination process.

The shelter consists of an inflatable frame and removable inner lining with partitions that typically divide it into five sections, each consisting of three cubicles. Typically, four sections could be used for walking casualties and the fifth for treating stretcher cases using the fold-away roller bed supplied as part of the kit.

The system includes a high-output, portable water heater, the Hughes PORTAheater100, for warming the water as required by most decontamination regimes or simply to avoid shocking the casualties.

A portable heater that delivers warm air to the shelter, can, in higher ambient temperatures, be switched to supply unheated air for basic ventilation. For night time operation, pole mounted lights ensure good illumination and safe operation and a generator allows the unit to be independent of mains power supply.

For more information, please contact:
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E-mail: sales@hughes-safety-showers.co.uk

INTRODUCING NEW PPS: PLYSU PROTECTION SYSTEMS BECOMES PROFESSIONAL PROTECTION SYSTEMS IN ASSISTED MBO

One of the world's leading manufacturers of Decon technology, **Plysu Protection Systems Ltd** has been the subject of a successful assisted management buy-out this month (January) changing its name in the process to Professional Protection Systems Ltd.

The company has been acquired from former owners, South African packaging giant, Nampak, for an undisclosed sum by Mark Whitcher, Director and General Manager of the old Plysu Protection Systems, with the assistance of outside backers.

Whitcher, who becomes Managing Director said, "In our former existence the company wasn't known in the market place as Plysu Protection Systems, but as PPS. In our new existence we shall still be known as PPS. This is all indicative of the way we propose to go. Like the name change all our other changes will be similarly subtle, but for the better, thus helping to allay the understandable fears that all customers, suppliers and employees have about change".

The new company will retain its site at Woburn Sands, near Milton Keynes, England for the foreseeable future where it has been since its creation in 1947. Traditionally one of Europe's leading manufacturers of air fed protective clothing the company has, built up a thriving export market in Decon showers for hazmat and mass Decon operations.

Currently the company exports to 30 countries and includes customers as diverse as the USAF, the Japanese Defence Forces, the French Government, Czech Fire Services and the Malaysian Civil Defence Corps.

New PPS is, says Whitcher, well funded with a healthy order book. One of its first tasks is to embark on an ambitious programme of investment in new manufacturing facilities as well as R&D. Another top priority is going to be the introduction of high profile customer training programmes with a strong focus on deploying the new Decon technologies.

For more information, please contact:
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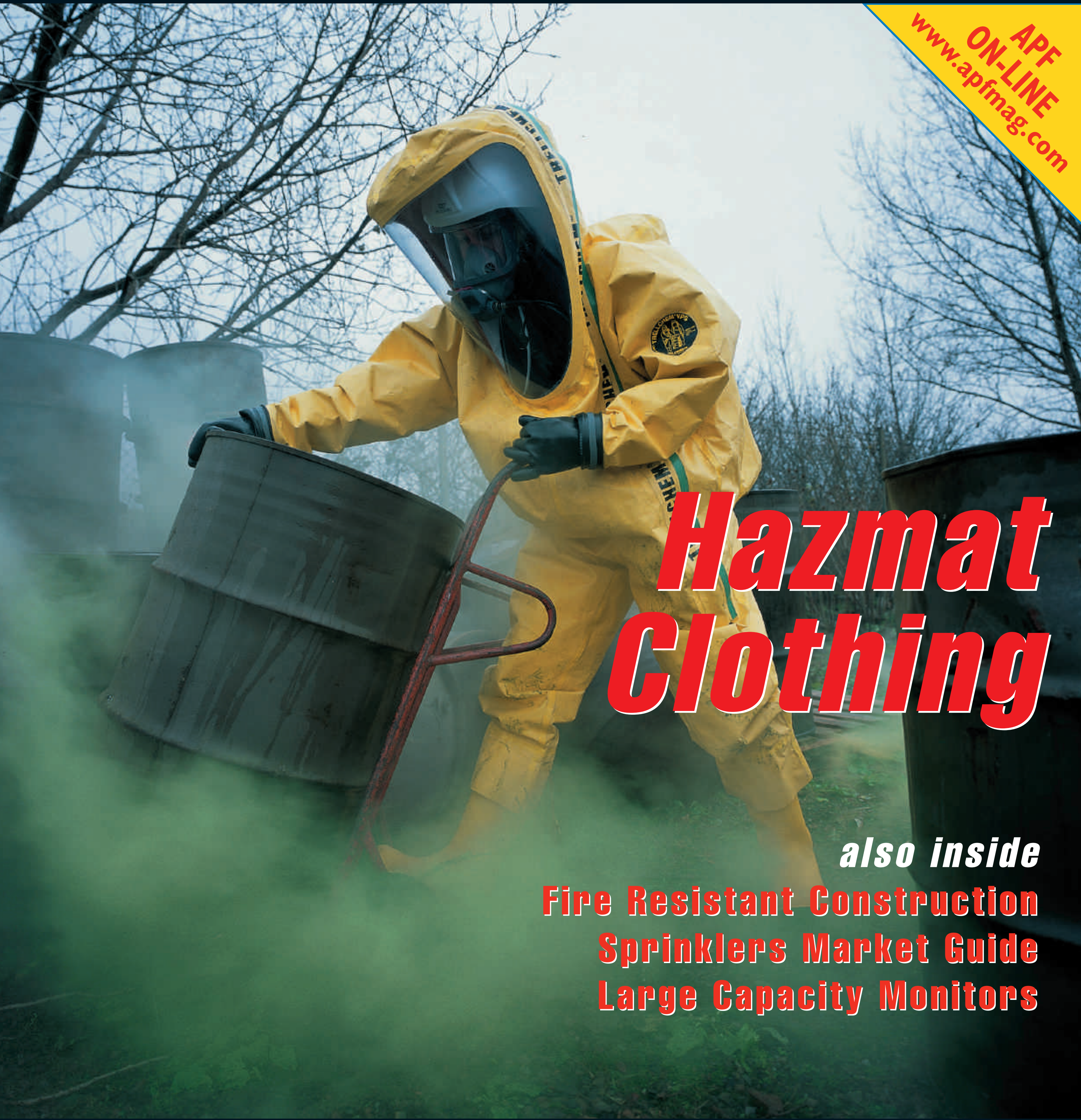

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Front cover picture: Courtesy of Trelleborg Protective Products AB

Publishers
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APF is published quarterly by:
MDM Publishing Ltd
18a, St James Street,
South Petherton, Somerset TA13 5BW
United Kingdom
Tel: +44 (0) 1460 249199
Fax: +44 (0) 1460 249292
e-mail: apfmag@globalnet.co.uk
website: www.apfmag.com

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Periodical Postage paid at Charnplain New York and additional offices
POSTMASTER: Send address changes to
IMS of New York, P 0 Box 1518
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USAUSPS No. (To be confirmed)

Subscription Rates
Sterling – £35.00 AUS Dollars – $100.00
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(Prices include Postage and Packing)
ISSN – 1476-1386

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Page design by Dorchester Typesetting Group Ltd
Printed by The Friary Press Ltd

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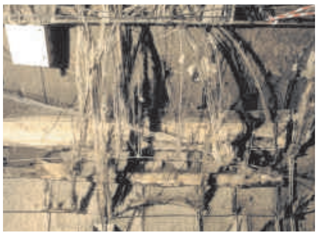

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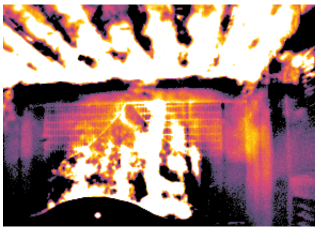

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FOREWORD

by Jeff Godfredson

NFPA's Asia-Pacific
Operations Director

Performance Based Codes

In recent times I have participated in a number of significant International Fire Conferences. A key topic at these events has been the issue of performance-based codes and the results of the work done using this framework. The concept of performance-based codes is not new; some countries have been using this concept for a number of years. Many other countries are in the process of moving to a regulatory environment, which will enable performance-based options. In setting their regulatory framework they will have the advantage of seeing the good and bad results of those who have gone before them. Many modern codes (such as NFPA 101) provide for both prescriptive and performance-based options. Before moving to performance-based codes the questions have to be asked about the relevance or adequacy of the existing prescriptive codes and to determine the current safety levels.

When the concept was initially proposed; as a serving fire officer I was skeptical about the outcomes. We have now had an opportunity to see the results. In my opinion the results has been mixed.

There are some in the fire/construction industry who have seen this as an opportunity to avoid the prescriptive requirement and dramatically reduce the fire safety equipment in buildings such as sprinklers. Some of the assumptions on which the decisions have been made are questionable.

Equally there have been many projects where through appropriate use of the tools available and good fire engineering the outcomes have produced safer buildings with most cost effective use being made of the available fire protection dollars.

The issue of change of use during the life of the building is still a concern for many in the fire service and those responsible for public safety. From my observations if a jurisdiction is not demonstrating adequate performance in ensuring conformance to prescriptive codes they need to have reservations about moving into a performance based environment.

Many countries are now reviewing the outcomes and considering future directions relative to performance-based codes. As a result of abuses in the system many are reconsidering a free and open system and are looking to return more power to regulatory authorities. In some cases the fire service will have final say over the acceptance of performance-based options. In others the performance-based option must be shown to demonstrate equivalence or better performance than the prescriptive option.

In many cases the abuses of the performance-based codes have been in areas other than fire protection such as noise reduction, waterproofing and foundations. Regardless of the types of problems the solutions will impact all areas of construction and engineering; including fire engineering.

I am sure there will be some interesting developments on this issue in the near future.

Jeff Godfredson
NFPA's Asia-Pacific Operations Director

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The Other End of the Telescope

The FC 500C alarm panel from Siemens FSP is able to differentiate between detectors and call points on the same circuit

ROB YATES, Product Marketing Manager (Fire) – Fire & Security Products at Siemens Building Technologies Ltd, suggests that the fire protection industry can learn much by taking on the end user's perspective when considering fire alarm and detection equipment.

It is a useful exercise for professionals within the fire alarm industry to consider fire alarm systems from an end user's perspective. In general an end user is concerned with opening his new property or continuing his day-to-day business. He is aware that often there is legislation requiring a fire alarm system to protect occupants and that failure to comply could result in the property closing while the problem is addressed, but knowledge beyond these basic assumptions is often sadly lacking. This is currently an area of concern for those involved in fire protection. Levels of awareness of the Fire Precautions Workplace Regulations are poor, with many building owners/occupiers unsure of their actual responsibilities in terms of fire safety. The new Fire Safety Order, scheduled to be introduced in Spring 2004, offers a real opportunity to address this issue to ensure that the end user's knowledge of fire safety legislation and his responsibilities under fire risk assessment are greatly improved.

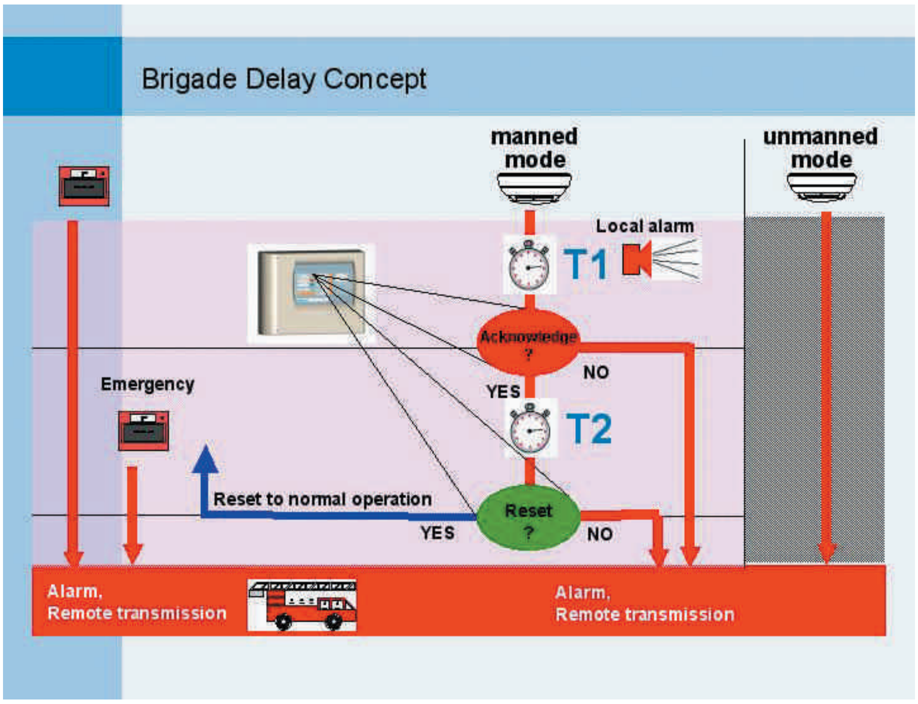
In the meantime, a consequence of this lack of understanding and the low priority often given to fire protection means that many fire alarm systems are therefore designed to provide the minimum protection sufficient to meet life safety legislation. To the customer this makes the system an essential burden rather than a useful facility. Every subsequent problem, be it a fault, an addition or a false alarm is seen as increasing that burden. The fire panel sits by the reception unloved and unwanted – a problem waiting to happen which will then further drain the customer's limited funds.

The problem with the customer is he does not usually understand the many ways in which fires can start, nor how rapidly they can develop. In fact many customers will have memories of how difficult fires are to start when lighting a fire at home or while camping. All customers will express their understanding of how dangerous fires can be but few deep down really understand why. Just how dangerous is not only an issue of life safety. The following facts help to put into context the potential financial consequences for a company:

- Fire is estimated to cost the UK economy some £7billion annually.
- An estimated 3 out of every 4 businesses that experience a serious fire go out of business either directly as a result of the fire or within 3 years of reopening.

Where the property is new, an architect or consultant often specifies the fire alarm system. The main or electrical subcontractor will then choose the system installer. The end user very often has no or at least limited involvement and, it therefore follows, very little interest. However it is the end user that will have to live with the system, experience every fault and false alarm and cover the ensuing costs.

Best practice therefore is to include the end user in the design and decision making process from the start. This is, though, usually impractical due to time constraints, other priorities and, of course, lack of customer interest. This does not excuse the system designer from at least attempting to consider the needs of his ultimate client; neither does it excuse them from attempting to show their client the benefits of a system that does a little more than the minimum required for legislative purposes.



The 'manned' option on a 'manned/unmanned' system allows signals to the brigade to be delayed

DETECTION

One problem that the end user is always conscious of is false alarms. He is capable of determining the rate, inconvenience and cost of false alarms caused by his system far more readily than the system's relative sensitivity or usefulness. The system's negative aspects are therefore much more prevalent in the customer's mind than the positive aspects.

In the early days of automatic detection many problems were experienced due to the products themselves. In particular problems relating to electro magnetic compatibility (EMC), mechanical design and crude optics led to a false alarm rate over and above those experienced purely through deceptive phenomena. Refinements made over the years have reduced false alarms significantly, a fact highlighted by the BFPSA (British Fire Protection Systems Association) and CACFOA (Chief & Assistant Chief Fire Officers Association) initiative on false alarms. In addition new technologies, higher processing power and sophisticated algorithms enable detection systems to filter out some of the problems created by deceptive phenomena while at the same time increasing sensitivity to a broader range of fire types.

Despite these advances, steam dust and aerosols can still trigger a basic point type detector. Even without these problems, burning toast, fuels, cooking by-products and other causes of smoke remain. Too often this causes the system designer to reduce the level of protection offered by the system. Smoke detectors are replaced by rate of rise heat detectors where production processes may affect them, rate of rise detectors are themselves often replaced by fixed temperature versions for similar reasons. Even worse, areas of detection can be removed completely, if not at the design stage then later by maintenance personnel or end users as an ultimate "fix" to the inconvenience of false alarms.

FALSE ALARM FILTERING

The problem with any reduction in detection is that the system becomes incapable of detecting fires when it is most needed or is at least considerably slower. With a little more thought during the design/specification stage this reduction in detection may be unnecessary. The simple fact remains that the overwhelming majority of false alarms are created while the premises are occupied while 67% of all fires occur after 6.00 pm when the building is unoccupied.

During occupied periods people who are very effective fire detectors can offset a reduced level of detection. However, when this reduction in detection is continued during unoccupied periods the performance of the system is severely compromised.

False alarm filtering is a useful method of maintaining sensitive detection during unoccupied periods while

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reducing false alarms during troublesome occupied periods. Basically the system works in two distinct modes: 'manned' and 'unmanned'.

In manned mode devices can be programmed either not to activate the sounder or to activate the sounder but not send an immediate signal to the fire brigade. Alternatively with modern analogue addressable systems it may be possible to reduce the sensitivity of some detectors by day and return to full sensitivity at night. Manual call points can be treated quite differently and conventional panels such as Siemens FC500C are now available with the facility to differentiate between detectors and call points on the same circuit. The important thing is that the system is returned to full sensitivity at night when the premises are unmanned. This should be done automatically.

COMMUNICATIONS

Of course false alarm filtering as discussed above assumes that the system has been connected in some way to the fire brigade. However many systems have no such connection. This means that the return on the end user's investment in a fire alarm system during unoccupied periods is nil. The positive arguments for the fire alarm system are reduced further.

Communication via an ARC (Alarm Receiving Centre) brings further benefits. Faults are monitored and engineers can be summoned automatically. Periods of isolation can be monitored and recorded, as can the user's weekly tests. The weekly test by the user is probably the most important aspect of the servicing of a fire alarm. Huge confidence can be gained in the system integrity if the weekly tests are done properly. In addition they are excellent at getting the end user to take some responsibility for the system. Instilling in the end user the habit of doing these tests can be another matter. However if these tests are recorded by the ARC then not only can proof be provided that these tests were undertaken but the ARC can remind end users of any lapses in their routine.

The more people are evacuated for spurious reasons, the less responsive they become, it is in everybody's interest to reduce these incidences of false alarms

ALARMS

People involved in the fire industry tend to respond to alarms rather more seriously than the wider public. When a hotel fire alarm system is activated at 3am most people in the trade will dutifully evacuate immediately. Those not from the industry will tend to see if the alarm is silenced in the early stages before dressing and staggering into the cold night air. The more people are evacuated for spurious reasons the less responsive they become. It is therefore everyone's responsibility in the trade to take the utmost care in providing alarms and detection systems that suit the situation.

Let's take the hotel example a little further. At 3am in the morning what are the likely causes of fires or false alarms. Fires can start from electrical faults, smokers, cooking, arson etc.

Occupants smoking in their rooms or the bar are a common cause of false alarms as are residents taking showers and activating the smoke detector within their rooms. Note here that the system designer has to consider the conflicting needs of the smoker: that is his tendency to cause false alarms weighed against his high fire risk.

Too often system designers respond to this challenge by reducing the level of detection. They may replace smoke detection with rate of rise heat detectors within the rooms. This form of detection is usually adequate to protect the other occupants in the hotel. However, they are not suitable for protecting the occupant of the room where the fire originates as smoke may overcome him before the detector is activated.

Providing the hotel is well staffed, bedrooms have adequate fire separation and that all other considerations required by risk analysis allow, then a two-stage alarm system can provide a high level of detection with a low level of false alarms and unnecessary evacuations.

It is possible for instance that a smoke detector within a bedroom can activate a sounder within that room only. At the same time staff can be alerted, but a full-scale evacuation of occupants delayed for a short period while the cause is investigated. If corrective action is not forthcoming or other detectors or manual call points are triggered then a full evacuation is commenced immediately. No such filtering need be instigated for detectors protecting kitchens, corridors, ceiling voids etc, – these will be programmed to immediately generate a general evacuation.

A great deal of time and energy goes into writing specifications for medium/large applications. Comparatively, very little thought goes into specifications for small/medium applications yet most of the facilities mentioned above are available in products aimed at this market. Too often smaller systems have no connection to the Fire Brigade, only operate on a one out all out evacuation and are never tested by the user. The only time the user notices that they have a fire alarm installed is when they are evacuated into the car park for no good reason. With a little more attention from specifiers and installers an end user can be left with a far more positive view and a greater feeling of involvement in their system.

Rob Yates
Product Marketing Manager
Fire & Security Products
Siemens Building Technologies Ltd,
Fire & Security Products Division

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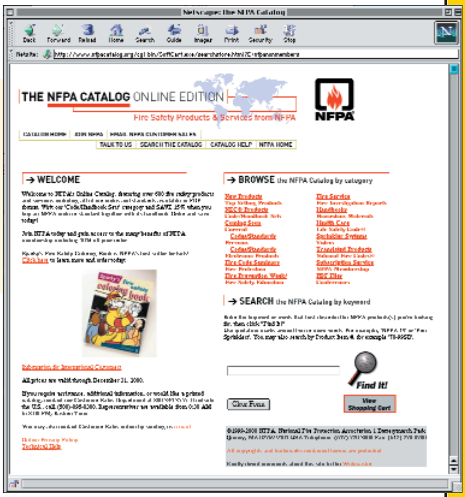
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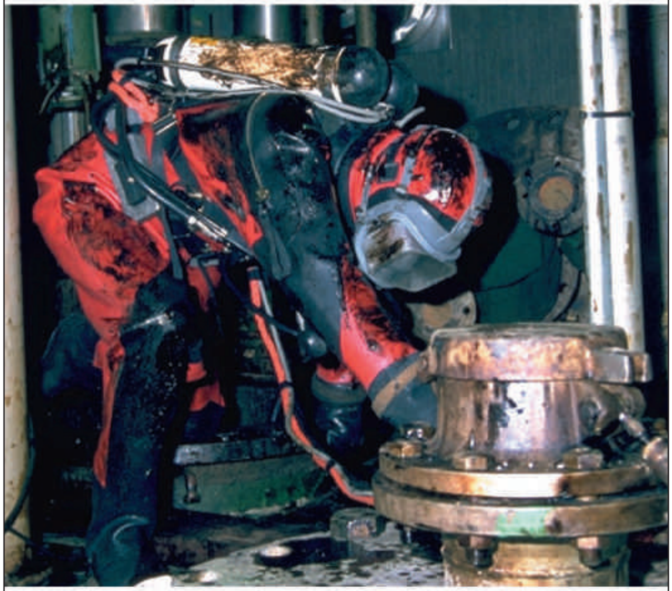

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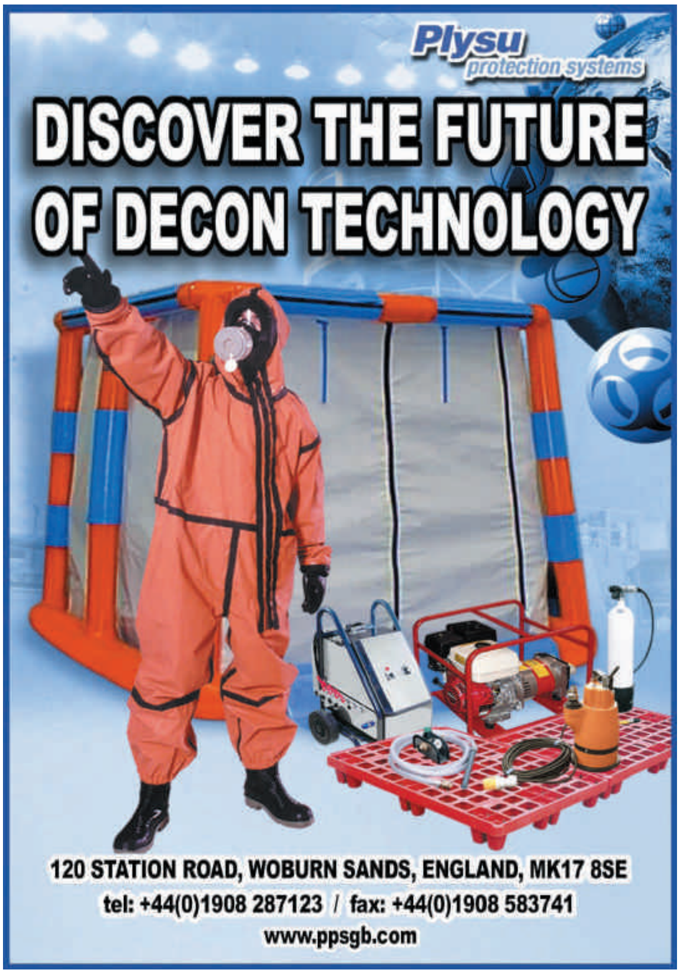

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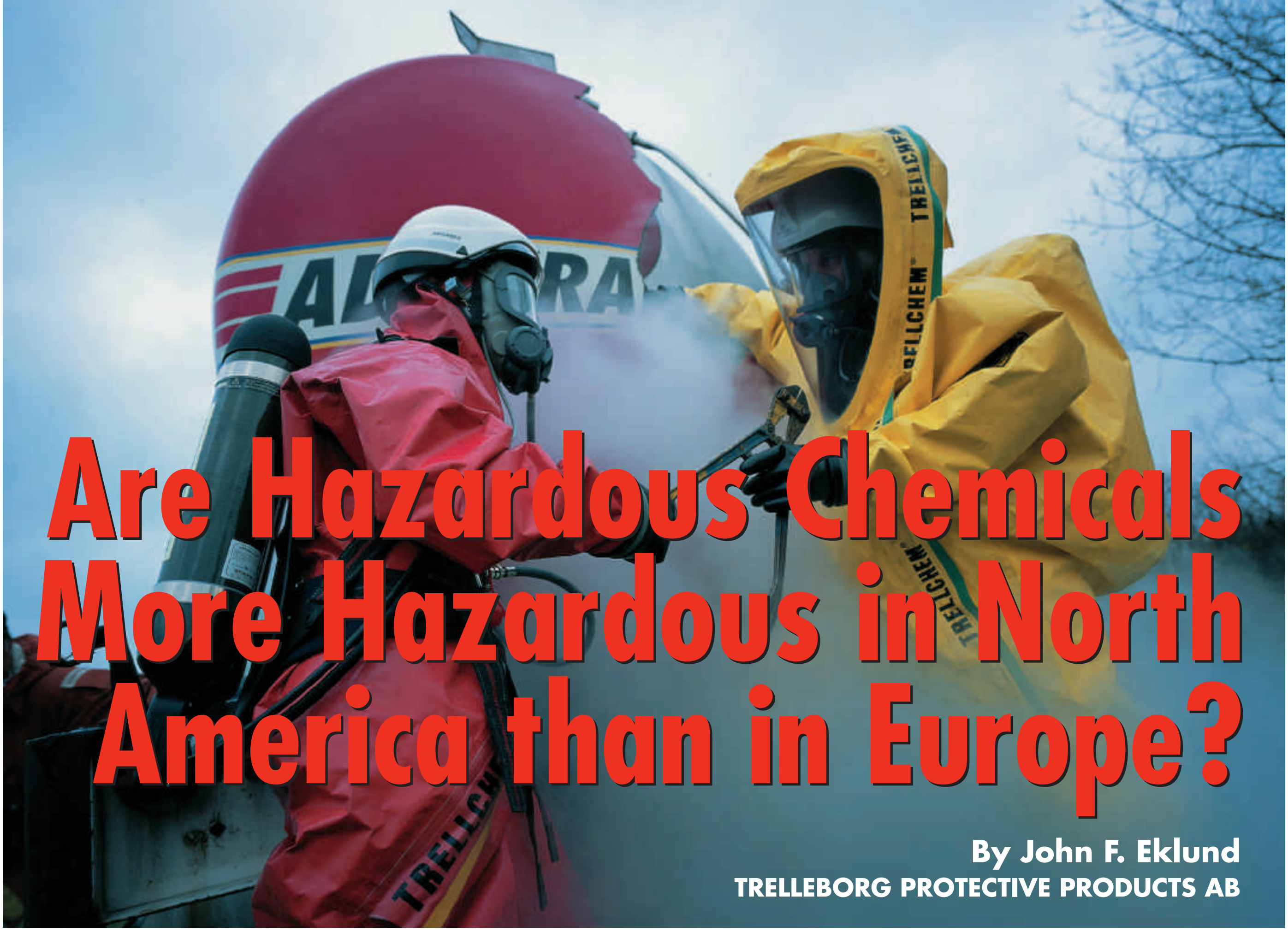

Are Hazardous Chemicals More Hazardous in North America than in Europe?

By John F. Eklund
TRELLEBORG PROTECTIVE PRODUCTS AB

A COMPARISON BETWEEN THE AMERICAN AND OTHER INTERNATIONAL STANDARDS FOR CHEMICAL PROTECTIVE CLOTHING

The answer to this question could, in fact, be "yes", if we were to base our comparisons on the differences between the US and other international standards for gas-tight chemical and chemical vapour protective clothing – called CPC for short.

Chemical protective clothing owes its origins to the results of NBC development programs for military use. These types of NBC protective suits have been developed further and modified so as to be suitable for use in civilian circumstances by fire and rescue services, civil defence personnel and also within industry.

Today the civil versions are widely used by the military or other defence related services for the purpose of bomb disposal, demilitarisation programs, including the disarming of weapons of mass destruction, anti terrorist programs, refuelling of rockets and similar tasks.

The purpose of chemical protective clothing is to protect the wearer from direct skin contact with hazardous substances in their various forms.

There are a surprisingly large number of different hazardous substances in use today. A fair estimate is that, worldwide, they number about 8 million[1]!

It is a sad fact that at this present time we know far too little about the effects on human beings resulting from skin contact with most of these substances and therefore it is absolutely essential to establish an optimal level of protection to the wearers of chemical protective clothing. This is known as the protective factor and often called PF for short.

Chemical protective suits are available in many different designs and materials with numbers of different options. The factors determining the choice of CPC must be the protective factor that is to be provided to the wearers based on the uses to which the suits are to be put.

In many instances the choice of type of protective clothing is based on a kind of tradition, often due to lack of regulations or even guidelines from any health authority relating to the use of such clothing. Availability of a sufficient budget can also be an important factor.

The differences between the US and other international standards can be clearly visualised by focusing on chemical protective suits, which are considered to provide the highest possible level of protection. These suits are usually referred to as "A" level suits.

A-level suits should provide protection against all hazardous chemicals or other materials in whatever form they may arise, liquid, gaseous, in vapour or in solid form.

Chemical protective clothing and the use of this type of equipment has only reached the civil sector relatively recently and this is the reason for the lack of comprehensive product standards and test procedures for type approval that still remain to be fully established and internationally adopted.

Until the 1990s the only recognised standards in existence were, in principle domestic, such as the German vfdb and the British BS.

United States vs. Europe

Currently there are two major internationally recognised standards available.

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[1] National Research Council, USA

Picture courtesy of Trelleborg Protective Products AB

These are the American standard NFPA 1991 and the joint European standard EN 943.

Many professional users regard the American NFPA 1991 standard as the better of the two. It is user-friendlier with distinct documentation and clearly defined borderlines of minimum requirements. The structure of the European EN 943 standard is of a more complex nature. It offers a number of options for different classes of the minimum requirements, which are not easy to interpret, unless someone is a qualified expert on the subject.

It can be assumed that the reason for this is that the European standard has been drawn up, discussed, negotiated, compromised and agreed upon among all the 15 member countries of the European Union.

Some differences between the two standards can be determined.

Abrasion prior to chemical resistance test

The American NFPA 1991 standard stipulates the abrasion of suits to simulate wear and tear in service prior to the suits being tested for resistance to chemicals and other hazardous substances.

The European EN 943 standard contains no such stipulation relating to abrasion prior to chemical resistance tests.

This leads to the first conclusion.

The US standard recognises the fact that a chemical protective suit is not only exposed to contact with hazardous and aggressive substances but also to wear and tear during its service.

Chemical permeation resistance test

The chemical resistance protection factor is established by means of what is known as "The Permeation Test". This is a test that is clearly stipulated in both the American NFPA and the European EN standards.

The stringent American standard stipulates a maximum detection level or permeation rate of only 0.1 mg/cm^2 per minute during a test period with a minimum duration of 60 minutes.

The European standard allows a maximum detection level or permeation rate of 1.0 mg/cm^2 per minute – ten times more than its American counterpart – during a test with a duration of only 10 minutes. In the case of emergency teams the test period is increased to 30 minutes – one sixth or one half of the American norm.

Are then hazardous chemicals more hazardous in North America than in the rest of the world?

This rhetorical question naturally leads to the second conclusion. No, of course hazardous chemicals are not more hazardous in the US. But it must be assumed that the rest of the world's meagre knowledge of the effects of contacts between human skin and hazardous substances has been given much more consideration by the US standards committee than by other international organs of standardisation.

The duration of the test – an important factor

The minimum duration of the chemical resistance or permeation test stipulated in the American standard, as already stated, is 60 minutes. However, if no breakthrough or other failure has occurred within this period of 60 minutes the test must continue for a further period of up to 180 minutes or until such a breakthrough or failure has occurred.

The European standard states that if the test period of ten minutes is applied for its chemical resistance/permeation test and has been passed successfully, i.e. without any breakthrough or failure within the stipulated ten minutes – no more, no less – then the suit is approved. Thus, no "tolerances" are established, nor is any information gained as to exactly when breakthrough or any other failure may occur in the suit being tested.

Which end up in the third conclusion. A type approval protocol according to the American NFPA 1991 standard offers significantly more qualified, more valuable, more useful and more important information to the user than any other international counterpart.

Test temperature – a limiting factor

An important factor, which limits the value of the permeation or chemical resistance test results under both the American and for instance European standards, is that, the tests need only to be carried out at one fixed temperature.

The temperature stipulated under the American standard is +27°C (+81°F) and for Europe it is +20°C (+68°F).

This fact forms the basis of the fourth conclusion. A hazardous or aggressive substance is generally much more aggressive at a high temperature than at a low one. Under the rules of the American NFPA 1991 standard the chemical resistance test is not only carried out on a suit that has been exposed to simulated wear and tear, the suit is also exposed to chemicals at a higher temperature which means these chemicals are more aggressive. There is no doubt that the US chemical resistance test is far more stringent than for instance its European counterpart and its results, once again, of much greater value.

Flame test

The US standard also stipulates a more severe flame test than its European counterpart. Furthermore, the US standard requires a suit to be in contact with flames for a longer period of time. The European standard offers various different options for different classes of flame tests and requirements.

The fifth conclusion then becomes:

Picture courtesy of Trelleborg Protective Products AB

That the existence of a number of different "look alike" options in the European standard requirements could easily lead to misinterpretation and misjudgements when selecting this type of protective equipment.

American standard NFPA 1991 is a superior standard

Although, for instance the European standard EN 943 has been developed after the American NFPA 1991 its requirements are not nearly as stringent. There is, however, one exception, and that is the pressure leakage test requirement. With this exception, a general conclusion can be drawn that chemical protective clothing which has been tested and type approved according to the American NFPA 1991 standard offers better protection to the wearer against chemicals and other hazardous substances than a corresponding suit tested and type approved for civil use according to the only standards applied in the rest of the world today.

If this is not sufficient, finally a type approval in accordance with the American standard NFPA 1991 is not a one-time event. It is subject to annual audits by the relevant authority. These annual tests may not only cover a variety of key product features in a sample of suits – they extend all the way back to the supplier's manufacturing procedures and quality assurance.

Confined space entries – mission impossible?

Standards and type approval procedures establish the best possible foundations for the evaluation process in finding and selecting new personal protective equipment and chemical protective clothing. However, sometimes these standards bring limitations and some can actually create problems.

A typical case could be entries into confined spaces, difficult access and narrow entries, where a gas and vapour-tight chemical protective suit is required in order to provide a sufficient level of protection to the wearer.

Currently it is only possible to obtain a type approval certificate according to the American standard NFPA 1991 for suits of so-called totally encapsulated type where the self-contained breathing apparatus is carried inside the suit and is protected by it. This is in spite of the fact that a totally encapsulated CPC suit of this type with a breathing apparatus inside it, becomes rather large in volume and therefore may prevent safe entry into a confined space and even jeopardise the safety of the wearer. The "big suit" design undoubtedly runs a greater risk of being punctured during work.

Currently the market does offer non-encapsulated suits with the breathing apparatus on the outside of the gas and vapour-tight chemical protective suits and these are clearly better for use in confined space entries than the bulky totally encapsulated suits.

Unfortunately the American NFPA 1991 standard currently makes it impossible to obtain type approval for a non-encapsulated vapour and gas-tight suit even if the suit is made of approved and certified materials. The main reason for this is that the market simply does not offer any SCBA units that have been additionally tested and certified to conform with the American NFPA 1991 standard.

The European EN 943 standard, which is structured in a completely different way and is not as stringent as its American counterpart, does provide for certification of non-encapsulated gas, vapour and chemical protective suits.

Disposable or limited use type suits?

Advanced limited use or disposable protective suits are today based on very thin barrier films or foils laminated together. These films or foils, in their turn, are usually laminated to highly porous substrates, which have relatively poor tensile strength properties. In some rare cases laminated to a strong flexible fabric, forming a solid unit. The materials for suits of the limited use or disposable type are available with either a single coating on the outside or they can be double coated with a coating on both inside and outside. The ultra thin

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films, which are used, are naturally very sensitive to mechanical stresses and abrasion and also to exposure to flames and heat. As a result any mechanical damage such as scratches or cracks is virtually impossible to detect visually without the aid of special instruments.

These difficulties in detecting any possible damage to the barrier laminate make it extremely difficult for the user to decide if it is safe to reuse a suit of limited use type even if it has not been exposed to any hazardous substances during the intervening period.

According to the American NFPA 1991 standard an additional outer protective cover, often referred to as a flash cover, must be worn over a certified garment of disposable or limited use type in order to protect the sensitive material of the garment against abrasions, etc., and, in addition, to provide extra protection to the wearer against flames and chemicals that cause high temperatures by thermal reactions.

This additional flash cover is a necessity for the disposable or limited use type of suits, in order to be able to pass the pre-abrasion conditioning phase which is mandatory under the American standard NFPA 1991 and which precedes the actual chemical permeation resistance test, as has already been described.

Can we rely upon standard test methods when applied to disposable or limited use suits?

Can we really trust the standard methods of testing suits to establish their degrees of resistance to permeation and breakthrough by hazardous substances if these methods are applied to disposable or limited use suits or garment materials?

The answer is generally “Yes”. However, these tests have been the subject of much discussion and questions have been raised as to whether permeation test procedures used really reflect real world situations. This applies particularly to tests of the materials used in the manufacture of disposable and limited use suits as these materials incorporate a highly porous and relatively thick substrate.

Picture courtesy of Trelleborg Protective Products AB

The discussions that have arisen centre on the fact that the test methods described in both the American NFPA and the exemplified European EN 943 standards fail to stipulate that the edges of garment samples undergoing tests must be sealed. The question is therefore; does this highly porous substrate allow any molecules of the chemical substance being used to test the garment to disappear during the detection process? If the edges are not sealed some molecules could actually escape via the highly porous substrate, getting away through the unsealed edges and thus escaping detection. The results of this test would then be misleadingly positive due to samples that leak.

Does limited use mean limited protection?

The term limited use suit tends to give a wrong impression. A better term perhaps would be disposable or advanced disposable suit. This would be more correct since this type of chemical protective clothing is made from disposable garment materials.

Evaluation – an important task

The complexity of the different standards and types of applications requires a profound and comprehensive evaluation process before a decision is made on the selection of the next generation of chemical protective clothing. Even the word clothing in this concept is perhaps slightly inadequate. The decision will not be about a piece of clothing. It will be about a life support system – the last but perhaps most valuable link in your chain of protective equipment. And someone’s life could depend on it.

What is then the final conclusion? Well, the answer is that it is in the responsibility of each and every one of us to face the consequences of our own actions. However, the right choice of CPC clothing for whatever application or situation its users must face will make a considerable difference on how the work is carried out and ultimately the wellbeing of the user. Maybe the old saying, “better safe than sorry” can be applied?

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Remote Cont

By Bill Flynn

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BUILDING A HOME IN A REMOTE REGION with spectacular mountain scenery or with the splendid isolation and tranquility of the desert is a dream come true for many urban dwellers. But it's a dream that can rapidly become a nightmare if homeowners aren't willing to change their attitudes toward fire protection.

Chris Heftel, a Washington state land developer, has seen how destructive wild-fire can be. So he wanted to minimize the chances that such a disaster would destroy his latest project, an upscale, gated community of $500,000 single-family homes on Lookout Mountain, about 7 miles (11 kilometers) from Spokane.

At first, he was inclined to suggest that prospective buyers follow the concepts outlined in the Firewise Communities/USA program as part of their development contract. But when he was ready to start building last summer, Heftel decided to require prospective buyers to sign a covenant legally binding them to use fire-resistive building materials and follow wildfire prevention practices modeled after those in the Firewise program. When fully built, the development's nearly 100 homes will all be structurally fire-resistive and have a defensible zone around them.

It was a bold step, but Heftel says, no one buying into the River Bluff Ranch development has refused to sign.

"We made it clear to everyone how important it is to use fire-resistive building materials and to be committed to fuels maintenance in an environment such as this," Heftel says.

Firewise Communities/USA is an education program sponsored by the National Wildland/Urban Interface Fire Protection Program, a consortium made up of the USDA Forest Service, the U.S. Department of Interior, the National Association of State Foresters, the U.S. Fire Administration, and NFPA. The consortium's covenants, which require fire-resistive building materials and defensible zones around properties, are a new concept in the wildland/urban interface. However, community adoption of wildfire standards such as NFPA 1144, *Protection of Life and Property from Wildfire*, is becoming common in many areas, as residents realize that the most effective way to avoid destruction from wild-fires is proper construction and fuels maintenance.

"This particular mountain has never had a serious wildfire, but the forest is very vulnerable because unhealthy growth has been allowed," Heftel says. He says River Bluff Ranch is uphill and upwind from 1,000 acres (404 hectares) of public land that hasn't been maintained and is overloaded with fuels.

Among the requirements of the River Bluff Ranch covenants are paved two-lane roads, secondary evacuation roads, and a network of forest roads. Also required are underground utilities; a series of non-potable-water storage tanks with dry hydrants; fire-resistant roofing, double-paned windows, deep side yard setbacks, defensible space, and vegetation maintenance; and an on-site caretaker, equipment, and shop.

The covenants further require that the community's homeowners' association, when formed, enforce the covenants, educate the residents, maintain the roads and water storage facilities, manage an ongoing forest stewardship program, and implement the recommended Firewise Communities budget – currently $2 per person – to be used for future Firewise efforts.

"No one balked at committing to the Firewise covenants," Heftel says. "They view it as physical protection for themselves and their property, and an enhancement to the value of the house."

It's an attitude that Heftel views as a remarkable change.

"Only about five years ago, a similar, upscale development was constructed several miles from here that wouldn't allow anything but wood-shake shingles for the roofing," he says. "Shakes won't come anywhere near this development."

CHANGING HABITS IN MONTANA

Washington isn't the only wildfire-prone state in which NFPA 1144 is used to convince homeowners to change their building material and construction habits. Frenchtown, Montana, with a population of 1,700, adopted NFPA 1144 in 1998.

"One of the things I like about the

> *Among the requirements of the River Bluff Ranch covenants are paved two-lane roads, secondary evacuation roads, and a network of forest roads.*

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code is it's a standard we can refer to," says Frenchtown's Fire Chief Scott Waldron. "Except for the cities, there's no building code in Montana, so NFPA 1144 is a tool that we use with builders and homeowners to change their habits regarding the materials they use and the need to cut back on fuels."

NFPA 1144 provides those responsible for fire protection, land-use planning, property development, property maintenance, and others responsible for, or interested in, improving fire and life safety in wildfire-prone areas with minimum requirements for planning, construction, maintenance, fire prevention, and management.

Waldron, whose department covers 150 square miles (388 square kilometers), says that, after adopting NFPA 1144, the community applied for grant money to do risk assessments throughout the town.

"We mapped high-risk areas using GPS (global positioning system) and targeted them for mitigation work," Waldron says. "Then we went to each of the homeowners and explained the risks, both in fuels buildup and construction on the property that was putting the structure at risk."

He says the grants also helped to secure extra help for a fuels-reduction program. "We've managed to do about 200 properties so far," he notes.

Before new homes can be constructed, the prospective owners must obtain a fire safety permit from the fire department. At this point, Waldron uses NFPA 1144 to inform the homeowners what they need to do to before construction.

"And we go back and check before the permit is issued," he says.

"I think one of the biggest mistakes we make in the business of fighting wildland fires is telling people that we will be there to protect them, because that's not always true," Waldron says. "But in the past few years, I think we've made a lot of progress in educating people on what they need to do, not only to have a defensible perimeter, but to use building materials that will allow a house to survive a crown fire."

According to the Structure Ignition Assessment Model (SIAM), a fire model developed by Jack Cohen, a scientist at the U.S. Forest Service's Fire Sciences Laboratory in Missoula, Montana, a fire-resistive wooden structure surrounded by a 100-foot (30-meter) area in which fuels have been thinned has a good chance of surviving a fast-moving crown fire. However, Cohen's research seems to indicate that the principal cause of home losses during wildfires isn't necessarily the buildup of fuels. Rather, it's the degree to which a home is vulnerable to ignition, a factor that's often overlooked when determining the cause of property loss during a wildland fire.

"A home's ignition zone is pretty much determined by the characteristics of its construction and its immediate surroundings, regardless of what wildfire might be moving through," Cohen says.

Key elements in a structure's ignitability are flammable roofs; burnable vegetation, such as ornamental trees and shrubs, close to the house; the lack of tempered-glass or double-paned windows; and he lack of ⅛-inch mesh to keep fronds from entering openings in the structure.

The research also seems to suggest that contemporary methods of fighting wildfires by reducing the fuel load may not be as effective as believed because thinning fuels on public lands does little to reduce the ignitability of a home on private land. It also suggests that the wildland/urban interface zone doesn't fully take into account the area of prime fire risk and fuel hazards: the house and surrounding vegetation.

Cohen further stresses the importance of the conditions that exist when a wildfire is raging.

NFPA 1144 provides those responsible for fire protection, land-use planning, property development, property maintenance, and others responsible for, or interested in, improving fire and life safety in wild-fire-prone areas with minimum requirements for planning, construction, maintenance, fire prevention, and management.

"When an extreme event, such as an intensely hot wildfire occurs, many hundreds of structures may be destroyed," he says. "The involvement of urban fire apparatus at this point is pretty much ineffective."

He points to the Los Alamos, New Mexico, fire in 2000 as an example.

"At one point the fire was threatening 1,000 structures. How does fire apparatus cope with that?" he asks. "Under these extreme conditions, we don't have a choice over the fire's behavior. Where we do have a choice is the home ignition, that 100-foot (30-meter) radius around the house."

FLORIDA USES MONTANA RESEARCH

Jim Harrell, the wildland mitigation coordinator for the Florida Division of Forestry, says his division uses Cohen's research to encourage home-owners to create zones around their property to reduce ignitability.

"We took a close look at what Cohen found out in Montana to see how it applies to Florida," Harrell says.

Over the last three years Florida, which adopted NFPA 299, *Protection of Life and Property from Wildfire*, (NFPA 1144's former designation) as a reference item in the state's Fire Prevention Code, has assembled fire

Remote Control

management teams to help the state's 15 fire districts reduce fuel loads, especially those near private property.

Harrell says that Florida has had great success with Firewise workshops.

"We've had 20 one-day workshops since August 2000, and we've had real good attendance from builders and developers who are beginning to buy into the Firewise concepts."

Builders in other states are showing an interest, too. Among them is Leo Scott, who's made a good living for 30 years as a building contractor in Prescott City, a fast-growing community in the high desert of central Arizona. Since 1970, Prescott City's population has almost tripled, from 13,000 residents to nearly 36,000. In 2002, it grew at the rate of 3.3 percent annually, and federal census projections predict a population of 45,000 by 2014.

Prescott City is located in Prescott National Forest 75 miles (121 kilometers) north of Phoenix, 90 miles (145 kilometers) south of Flagstaff, and about a mile (1.6 kilometer) above sea level. Its rugged beauty and hundreds of square miles of forest land is a magnet for thousands of new residents every year, most with little or no experience living in the wildland/urban interface.

"Construction, especially new home construction, is our biggest business," Scott says. "And people who buy property with plans to build a house have a certain expectation that construction costs will remain affordable. That's why there was concern among builders when workshops focused on building materials."

Those workshops were Firewise workshops, and concerned or not, the community opted to pursue the program, with as many people as possible involved in implementing Firewise techniques. Prescott City's been an active Firewise community since 1990, and Scott and his fellow contractors, as well as newer and long-time residents and fire officials from various jurisdictions, participate in the effort to maximize the city's fire resistiveness.

Throughout the 1990s, says Prescott City Fire Chief Darrell Willis, the Firewise Communities effort made slow, steady progress, but it was the Cerro Grande fire near Los Alamos that galvanized the community.

"That wildfire really got people's attention, and we got much more serious about our Firewise program and began stressing the need to use building materials that give structures a chance to survive a wildfire."

Scott says the use of fire-resistive materials was a "touchy subject" because the fire department is in a different business than builders.

"We're trying to produce a product that's marketable and affordable, and you have to be careful that you don't price yourself out of the market," he says. However, he acknowledges that many of the things the Firewise program advocates are just common sense and don't cost much.

"Something as simple as making sure all soffits are fully enclosed (to keep out fire brands) is easily done," he notes. "We were able to get closer to a balance between the need to use fire-resistive materials and a desire of homeowners to build attractive, affordable houses."

That wildfire really got people's attention, and we got much more serious about our Firewise program and began stressing the need to use building materials that give structures a chance to survive a wildfire.

Scott says he now regularly uses fire-retardant, Class A-rated shingles made of asphalt or masonry on roofs, although he doesn't often use treated wood because it needs periodic maintenance.

"Who's going to make sure that the wood gets re-treated to keep it fire-retardant?" he asks.

Because the Arizona climate is so dry, Scott says the use of wood on exterior walls is uncommon.

"It dries out quickly, rots, and then needs to be replaced." Instead, he usually applies one coat of stucco with a one-hour fire rating to exterior walls.

Arizona's climate also requires that homes have excellent ventilation.

"You can't eliminate ventilation in houses because you'll end up with mold and mildew and void the warranty on the new house," Scott says. His solution was to use ⅛-inch mesh to cover such openings as crawl space and attic accesses. It works.

"Flames in wildfires move so fast that there's not enough time for them to penetrate the much closer mesh," Scott says.

"The mesh really works to keep out fire brands and sparks and still allows the house to be well-ventilated," Willis says. Because fire officials worked closely with the building community in developing a consensus approach to choosing building materials, Scott says he's become an enthusiastic supporter of the Firewise program.

"The whole process has been very positive for our community," he says.

Even before a building permit is issued, however, the fire department inspects the land and identifies the vegetation that must be removed before construction can begin.

"We go out and tell them what needs to be done, how far back they must cut back the trees and brush and other fuels," Willis says. "And we go back to inspect and make sure it gets done before we issue a building permit."

Willis says that, over the past two years, Prescott City has received grant money from the federal government to help pay for a portion of the cost of crews to remove vegetation and create defensible space on property occupied by older homes.

> *No place in the United States is completely safe. There are floods, hurricanes, blizzards, tornadoes, and wildfires. Every spot in the United States has the potential to be affected by a force of nature, but wildfires don't elicit the same attitudes of self-reservation that those other forces do.*

"We've managed to treat more than 1,000 properties in two years," Willis says. "We're making a pretty good dent."

FALSE SENSE OF SECURITY

"No place in the United States is completely safe," says the NFPA's James Smalley, project manager for Firewise. "There are floods, hurricanes, blizzards, tornadoes, and wildfires. Every spot in the United States has the potential to be affected by a force of nature, but wildfires don't elicit the same attitudes of self-reservation that those other forces do."

Smalley, a nationally recognized expert on effective methods of minimizing the loss of life and damage caused by wildfires, believes many Americans, especially those new to the wildland/urban interface, have a false sense of security borne of their previous life in an urban or suburban environment.

"So much of our population has lived within 50 miles (80 kilometers) of a large or medium-sized city that we've become accustomed to expecting the local fire department to do it all," Smalley says. "But it doesn't happen like that in areas near wildlands."

Smalley says the issue is no longer how to protect people and property. Effective methods have already been identified. The primary issue now is educating people who live in the wildland/urban interface about these rules and procedures, and emphasizing how important it is that they be closely followed. In addition, Smalley says, it requires a change in attitude among these residents of remote regions.

"When living in the urban, built environment, people can get away with the attitude of 'I'm not responsible for my own protection.' But in the wildland, you're on your own," he says. "City dwellers are taking city-living concepts to places where they don't exist. We need to learn a lot more about living in the natural environment."

That's why the Firewise program and NFPA 1144 are playing such important roles in teaching people how to pick the right location for a house in wildland, how to landscape properly, and how to use fire-resistive building materials.

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GENERAL & COMMERCIAL SPRINKLERS MARKET GUIDE

Despite the influx of special application sprinklers such as extended coverage, storage sprinklers, and residential sprinklers, the vast majority of sprinklers installed today remain standard and quick response commercial sprinklers.

The term "standard" indicates sprinklers with coverage areas defined by NFPA 13 – the code governing most sprinkler installations. Maximum coverage areas are determined by the occupancy classification: Light, Ordinary I, Ordinary II or Extra Hazard. The greater the hazard, the higher the required discharge density. Hence, greater hazard occupancies require closer sprinkler spacing.

Standard sprinklers can be divided into four general categories:

UPRIGHT? Are installed above the branch line and discharge all water downward.

PENDENT? Are installed below the branch line and discharge all water downward.

SIDEWALL? Comprised of vertical sidewall and horizontal sidewalls, sidewall sprinklers discharge water across the room and along the wall from which they protrude. Horizontal sidewall Sprinklers point straight out from the wall; vertical sidewall sprinklers are installed either above or below the branch line.

CONVENTIONAL? Conventional or "Old Style" sprinklers can be installed in either the upright or pendent position. Conventional sprinklers discharge 40% of their water upward and 60% downward.

Here APF gives you what is probably one of the most extensive sources of product information you'll find on General & Commercial Sprinklers. No doubt most of you will be familiar with the company names represented here.

We have tried to ask as many pertinent questions as possible without getting over technical and again we're afraid space did not allow us to go into to much depth as far as each models advantages and disadvantages are concerned.

ANGUS FIRE

SPRINKLER	ANGUS 'S' THERMOMATIC	ANGUS'S' THERMOSPEED	ANGUS 'HC'	ANGUS 'HC' QR	ANGUS K1
STYLE	CUP/SSP/SSU	CUP/SSP/SSU	Concealed	Concealed	E.S.F.R
APPROVALS	LPC/F.M	LPC/F.M	LPC/UL	LPC/UL	LPC/F.M
K-FACTOR (metric)	K57/80/115	K57/80/115	K80	K80	K202
TEMPERATURES (C)	57--182	57--141	68 & 93	68 & 93	68 & 93
ELEMENT	Bulb	Bulb	Bulb 5mm	Bulb 3mm	Bulb 2mm
HAZARD	Light/Ord/High	Light/Ord/High	Light/Ord	Light/Ord	High
THREAD	1/2" BSP/NPT	1/2" BSP/NPT	1/2" NPT	1/2" NPT	1" NPT
RESPONSE	Standard	Quick Response	Standard	Quick Response	Quick Response
FINISHES	Brass Chrome Stainless Steel Titanium	Brass Chrome Stainless Steel Titanium	White Chrome Colours	White Chrome Colours	Brass

Angus Fire
Thame Park Road
Thame
Oxfordshire
OX9 3RT
Tel: +44 (0) 1844 214 545
Fax: +44 (0) 1844 213 511
E-mail: sprinkler@angusuk.co.uk

ANGUS FIRE CONT.

SPRINKLER	ANGUS 'S' RETROFIT	ANGUS 'HX' EXTRA LARGE ORIFICE (ELO)	ANGUS 'HSW'	ANGUS 'WHEC'	ANGUS 'METRON'
STYLE	Retrofit Heads	E.L.O.	Horizontal Sidewall	Extended Coverage Horizontal Sidewall	Metron Actuated
APPROVALS	LPC/F.M	F.M/UL	F.M / UL	LPC	LPC
K-FACTOR (metric)	K57 & K115	K166	80/115	80	57 & 80
TEMPERATURES (C)	57 - 141	68 - 141	57 - 182	57 - 79	57/68/79
ELEMENT	Bulb 3mm OR 5mm	Bulb 3mm or 5mm	Bulb	Bulb 3mm	Bulb & Metron Actuator
HAZARD	Light/Ord/High	NFPA13,231,231C,231D,231F	Light/Ord	Light/Ord	Light/Ord/High
THREAD	1/2" BSP	1" NPT	1/2" & 1" NPT	1/2" BSP	3/8" & 1/2" BSP
RESPONSE	Std/Quick Response	Std/Quick Response	Std/Quick Response	Quick Response	Std/Quick Response
FINISHES	Brass Chrome Colour	Brass Chrome Colour	Brass Chrome Colour	Brass Chrome Colour	Brass Chrome Colour

GLOBE FIRE SPRINKLER

SPRINKLER	Millennium	EFSR	GL 5628	GL 5654	Model X "ELO"
STYLE	Flush Pendent	Pendent	Extended Coverage HSW	Adjustable Concealed Pendent	Upright, Pendent
APPROVALS	UL, ULC	UL, FM(68C)	UL, ULC	UL, ULC, FM(80K)	UL, ULC, FM
K-FACTOR (metric)	80	212	80	39, 59, 80	166
TEMPERATURES (C)	57, 68, 79, 93	68, 93	57, 68, 79, 93	57, 68, 79, 93	68, 79, 93, 141
MAX. AREA (SQM)	53.12	13.28	42.5	29.88	15.94
THREAD (NPT)	1/2"	3/4"	1/2"	1/2"	3/4"
RESPONSE	Quick Response	Quick Response	Quick Response	Quick/Standard Response	Quick/Standard Response
FINISHES	Bright Chrome White Polyester Black Polyester	Factory Bronze Bright Chrome White Polyester Custom	Factory Bronze Bright Chrome White Polyester Custom	Bright Chrome White Painted Bright Brass Custom	Factory Bronze Bright Chrome White Polyester Custom

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4077 Air Park Drive
Standish
MI 48658
USA
Tel: +1 517 846 4583
Fax: +1 517 846 9231
E-mail: globe_man@msn.com

RELIABLE FIRE SPRINKLER

SPRINKLER	F1	F1FR	G4FR	F1FR	G
STYLE	Pend/Up/Conv/SW	Pend/Up/Conv/SW	Concealed	Pendant EC	Pend/Up/Conv/SW
APPROVALS	UL/FM/LPC/VDS	UL/FM/LPC/VDS	UL/FM/LPC/VDS	UL/FM	UL/FM/LPC/VDS
K-FACTOR (metric)	59,81 and 115	59,81 and 115	81	81 and 115	59,81 and 115
TEMPERATURES (C)	57 - 182 inc	57 - 141 inc	57 cover/74 sprinkler	57/68	57 - 141 inc
ELEMENT	Glass Bulb	Glass Bulb	Fusible	Glass Bulb	Fusible
HAZARD	Light, Ord, XHH	Light, Ord, XHH	Light / Ord	Light	Light, Ord, XHH
THREAD (NPT)	3/8", 1/2" and 3/4"	3/8", 1/2" and 3/4"	1/2"	1/2" and 3/4"	3/8", 1/2" and 3/4"
RESPONSE	Standard	Quick	Standard	Quick	Standard
FINISHES	Bronze Chrome White	Bronze Chrome White	Bronze Chrome White	Bronze Chrome White	Bronze Chrome

Reliable Fire Sprinkler Limited
Unit A2, Epsom Business Park
Kiln Lane
Epsom
Surrey KT17 1JF
Tel: +44 (0) 1372 724 461
Fax: +44 (0) 1372 728 899
E-mail: rfsl@globalnet.co.uk

RELIABLE FIRE SPRINKLER CONT.

SPRINKLER	GFR	ZX-1	FIFR	F1FR/CCP	G3
STYLE	Pend/Up/Conv/SW	Pend/SW	Recessed	Concealed	Dry Pend / SW
APPROVALS	UL/FM/LPC/VDS	UL/LPC/VDS	UL/FM/LPC/VDS	UL	UL/FM/LPC
K-FACTOR (metric)	53,81 and 118	59 and 78	41,59,81 and 115	81	79 to 83
TEMPERATURES (C)	74	74	57 -141	57 / 79	57 to 141
ELEMENT	Fusible	Fusible	Glass Bulb	Glass Bulb	Fusible
HAZARD	Light, Ord	Light, Ord (Life Safety LPC)	Light / Ord	Light / Ord	Light / Ord
THREAD (NPT)	3/8", 1/2" and 3/4"	7/16" and 1/2"	3/8", 1/2" and 3/4"	1/2"	1"
RESPONSE	Quick	Quick	Quick	Quick	Standard
FINISHES	Bronze Chrome	Chrome White	Bronze Chrome White	Chrome White	Bronze Chrome

GENERAL & COMMERCIAL SPRINKLERS

MARKET GUIDE

CENTRAL SPRAYSAFE

SPRINKLER	TY-B	TY-FRB	TY-L	TY-FRL	Series RFII
STYLE	Upright, Pendent & Recessed Pendent	Upright, Pendent & Recessed Pendent	Upright, Pendent & Recessed Pendent	Upright, Pendent, & Recessed Pendent	Concealed Pendent
APPROVALS	UL, FM, C-UL, LPCB, VdS (varies) & Others	UL, FM, C-UL, LPCB, VdS (varies) & Others	UL, C-UL, FM, LPCB	UL, C-UL, FM, LPCB	UL, C-UL, FM
K-FACTOR (metric)	40,3: 80,6: 115,2	40,3: 60,5: 80,6: 115,2	80,6: 115,2	40,3: 80,6: 115,2	80,6
TEMPERATURES (C)	57, 68, 79, 93, 141, 182	57, 68, 79, 93; 141 (Fully Exposed Only)	74, 100; 138 (Fully Exposed Only)	74, 100	68 (57 Plate); 93 (74 Plate)
MAX. AREA (SQM)	20.9 (LH), 12.08 (OH)	20.9 (LH), 12.08 (Others)	20,9 (LH), 12.08 (Others)	20,9 (LH), 12.08 (Others)	20,9 (LH), 12.08 (Others)
THREAD (NPT)	1/2", 3/4" (115,2)	1/2", 3/4" (115,2)	1/2", 3/4" (115,2)	1/2", 3/4" (115,2)	1/2"
RESPONSE	Standard	Quick	Standard	Quick	Standard & Quick
FINISHES	Natural Brass Chrome Plated White Polyester Lead, Wax, Wax Over Lead	Natural Brass Chrome Plated White Polyester Lead Coated	Natural Brass Chrome Plated Lead, Wax, Wax Over Lead	Natural Brass Chrome Plated	Bright Brass Chrome Plated White Custom Colors
THERMAL ELEMENT	Glass Bulb	Glass Bulb	Solder Link	Solder Link	

Tyco Fire & Building Products
No. 45 Tuas Avenue 9
Singapore 639189
Phone: 65-6743-3212
Fax: 65-6743-9181
Website: www.tycoasia.com

CENTRAL SPRAYSAFE CONT.

SPRINKLER	TY-ELOC	BV-20 QR	BV-EC	TY-B	TY-FRB
STYLE	Concealed Pendent	Pendent & Recessed Pendent	Sidewall & Recessed Sidewall	Vertical, Horizontal Sidewall & Recessed Horiz. Sidewall	Vertical, Horizontal Sidewall & Recessed Horiz. Sidewall
APPROVALS	UL, C-UL	UL, ULC	UL, C-UL, FM	UL, C-UL, FM, LPCB	UL, C-UL, FM, LPCB
K-FACTOR (metric)	161,3	115,2	80,6	80,6	80,6
TEMPERATURES (C)	71 (57 Plate); 100 (74 Plate)	57, 68	57, 68, 94	57, 68, 79, 93, 141, 182	57, 68, 79, 93, 141
MAX. AREA (SQM)	30,25 (Quick); 37,2 (Standard)	30,25; 37,2 (57 Only)	To 29,9 - See Tech Data	18,2	18,2
THREAD (NPT)	3/4"	3/4"	3/4"	1/2"	1/2"
RESPONSE	Standard & Quick	Quick	Standard & Quick	Standard	Quick
FINISHES	Bright Brass Chrome Plated White, Black Custom Colors	Natural Brass Chrome Plated White Polyester	Natural Brass Chrome Plated White Polyester	Natural Brass Chrome Plated White Polyester Wax, Lead, Wax Over Lead	Bright Brass Chrome Plated White Lead Coated
THERMAL ELEMENT	Solder	Glass Bulb	Glass Bulb	Glass Bulb	Glass Bulb

SO HAVE WE.

At Tyco Fire & Building Products, innovations such as the ESFR-1, K17 Storage Sprinklers, ESFR-17, ESFR-25 and EC-25 are just a few examples of our commitment to meet the dynamic challenges of the 21st century.

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Enquiries: tom.prymak@tycofp.com

GENERAL & COMMERCIAL SPRINKLERS

MARKET GUIDE

VIKING CORPORATION

SPRINKLER	Micromatic Model M	Micromatic HP	Micromatic Model M	Micromatic Model M	Microfast Model M	Microfast Model M	Micromatic Model I M
STYLE	Upright, Pendent or Conventional	Upright, Pendent or Horizontal Sidewall	Upright, Pendent, Horizontal Sidewall	Vertical Sidewall, Horizontal Sidewall	Upright, Pendent or Conventional	Vertical Sidewall, Horizontal Sidewall	Plain Barrel, Adjustable Standard/ Recessed Pendent
APPROVALS	FM / UL / LPC / VdS *	FM / UL / LPC	FM / UL / VdS	FM / UL / LPC *	FM / UL / LPC / VdS *	FM / UL *	FM / UL / LPC *
K-FACTOR (metric)	39, 50, 57, 80, 115	39, 58, 79	40, 60, 81, 115	39, 80 *	39, 50, 57, 80, 115	39, 80 *	80
TEMPERATURES (C)	68, 79, 93, 141, 182	68, 79, 93, 141, 182	74, 104, 141	68, 79, 93, 141, 182	68, 79, 93, 141, 182	68, 79, 93, 141, 182	68, 79, 93, 141
ELEMENT	5mm Glass Bulb	5mm Glass Bulb	Fusible Link	5mm Glass Bulb	3mm Glass Bulb	3mm Glass Bulb	3mm Glass Bulb and 5mm Glass Bulb
HAZARD	*			*	*	*	*
THREAD (NPT or BSPT)	3/8", 1/2", 3/4"	3/8", 1/2"	3/8", 1/2", 17/32"	1/2"	3/8", 1/2", 3/4"	1/2"	1"
RESPONSE	Standard	Standard	Standard	Standard	Fast	Fast	Fast and Standard
FINISHES	Brass, Chrome, White, Black, Navajo, Teflon, Bright Brass Wax, Polyester/Wax	Brass, Chrome, White, Black, Navajo, Teflon, Bright Brass, Wax	Brass, Chrome, Wax, White	Brass, Chrome, White, Black, Bright Brass, Plain Wax, Paint/Wax	Brass, Chrome, White, Black, Bright Brass, Plain Wax, Paint/Wax	Brass, Chrome, White, Black, Bright Brass, Plain Wax, Paint/Wax	Brass Chrome Stainless Steel

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Fax: +65 278 4609
E-mail:
vikingsingapore@vikingcorp.com
Website: www.vikingcorp.com

VIKING CORPORATION CONT.

SPRINKLER	Model A4 ESFR	ESFR	Model S1 ESFR	High Challenge	Model M	Mdl B1 Horizon Mirage
STYLE	Upright	Pendent	Pendent	Upright	Upright, Pendent	Pendent
APPROVALS	FM	FM	FM, UL, VdS	FM / UL	FM / UL *	FM / UL / LPC
K-FACTOR (metric)	202	363	202	161	166	80
TEMPERATURES (C)	74	74, 96	74, 96	68, 93, 141	57, 68, 79, 93, 141	72, 74, 104
ELEMENT	ESFR	ESFR	ESFR	Large Drop	Extra Large Orifice	Concealed
HAZARD	*		*	*	*	*
THREAD (NPT)	3/4"	1"	3/4"	3/4"	3/4"	1/2"
RESPONSE	Fast	Fast	Fast	Standard	Standard	Standard
FINISHES	Brass	Brass	Brass	Brass	Chrome Brass White, Black	Polished Chrome, White, Ivory, Black Custom Colour

*Please refer to the Viking Technical data sheet for specific information.

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PUZZLED?

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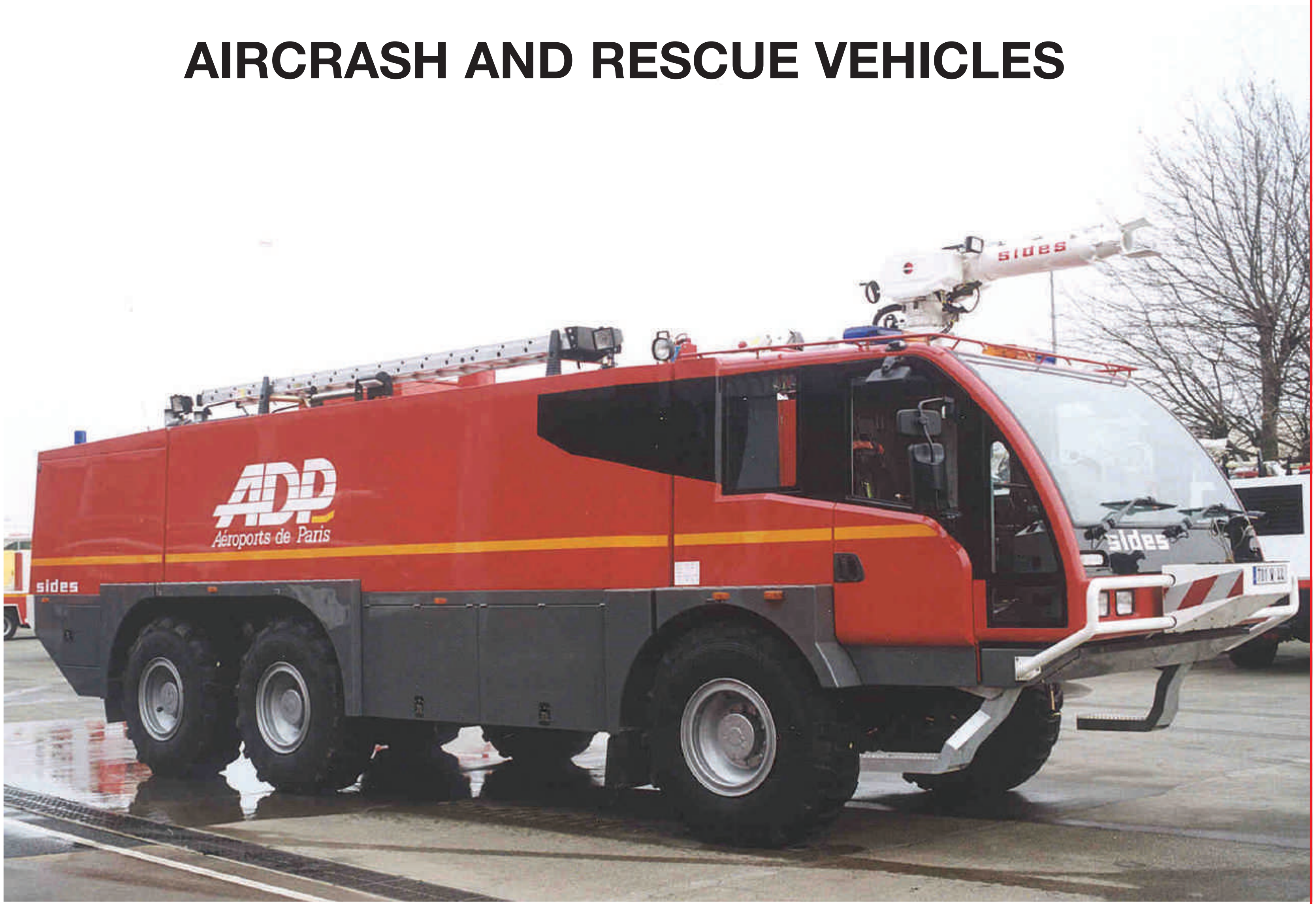

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Today's Aircraft Rescue Fire Fighting Vehicles

By Jorg Hitzler

Albert Ziegler Z8 in action

THE INCREASING AIR TRAFFIC all over the world requires the constant follow up for airport fire brigades to meet the challenges of security and safety. Especially in an area like the Asia Pacific region the pace of the development is so fast, that it needs a lot of energy, training, and research to be up to date.

New aircrafts with huge passenger capacities require new tactics and new technologies in fire fighting.

Many of the leading Vehicle manufacturers from the European and American fire industry are in close contact with fire brigades all over the world. Many have concentrated among other activities in further developing the material which is needed for efficient airport fire fighting.

In case of an incident within an airport during landing or take off, any actions must be very quick, should there be a chance to rescue the lives of the passengers and crew.

Some years ago it was standard to have so called rapid intervention vehicles (RIV), which were fast enough to be on the spot of an incident in short time and bigger, but slower trucks with a higher payload followed. The disadvantage of this system was the small capacity of fire extinguishing materials which could be carried by the RIVs and it took some time to get the necessary amount of water and foam to the place of the incident.

Albert Ziegler Z8 ALPAS® control panel

New truck technology from reputed chassis producers nowadays allows the use high powered, heavy trucks with excellent off-road capabilities and the possibility of carrying a considerable amount of fire extinguishing agents, so that they can combine both, the rapid intervention vehicles and the major crash tenders. Acceleration from 0-80 km/h in maximum 25 seconds for 40 tons GVW and top speed of around 140 km/h are no worse than with the former RIVs. Automatic gearboxes guarantee full concentration of the drivers and electronically controlled functions ease the activities of the fire crews and allow even small teams to be very effective.

To prevent fires in emergency landings some airports used to lay out foam on the runway to prevent sparking when the aircraft came down. This was and is a time consuming and very expensive method and its success is often doubted. The aircraft has to stay in the air for a long time and the foam may be diminishing already on the spot where it finally gets down.

With the new truck generation it is possible that some trucks are on standby near the runway and can accelerate their speed when the aircraft comes down, covering sparking and kerosine spills when the aircraft is still in motion. Standard roof monitors with a performance from 4000 to 6000 litres per minute enable attacks from a fair distance. Combined nozzles for water, foam and dry chemicals give a wide variety of additional fire fighting agents and make the job of the fire fighters highly efficient. Separate pump engines with a high

Albert Ziegler Z8 Kuala Lumpur Fleet

performance allow a 100% independence of pump operations from the driving performance, the operation is simpler and safer as with the power divider system, which uses the same engine for driving and pumping and, last but not least, does not show a difference in costs. Independent engines drive pumps with a performance up to 8000 litres per minute to feed roof and bumper monitors as well as handlines for leakage spills or body ground protection systems.

One of the biggest problems with the increasing number of passengers per aircraft is fighting cabin fires. First priority is to evacuate the passengers as quickly as possible, but on the other hand this prevents the access of fire fighters for an efficient attack.

The Snozzle® technology helps to overcome these problems. Fire trucks equipped with a hydraulic arm can approach the aircraft, extinguish engine fires under the wings and by using the piercing nozzle on top of the arm can bring extinguishing agents inside the cabin, thus cooling down the temperature quickly and avoiding the expansion of toxic gases. Research has shown that this tactic can increase the chances of survival for the passengers substantially.

New aircrafts with two or more passenger decks will most certainly require additional equipment like telescopic booms to reach higher areas of an aircraft. So the basic fleet of an airport fire brigade will have to change within the near future. It will have to consist of a combination of highly specialised vehicles for the various needs. Any combinations will be compromises, which do have their disadvantages.

Albert Ziegler Z8 with Snozzle®

Many of today's leading manufacturers have accepted the challenges by providing the necessary equipment for airport fire brigades and are constantly developing their products, co-operating with other companies to implement systems like the Snozzle® and others and combine them with their own research results.

With the opening of many new International Airports throughout the Asia Pacific area, many airports are now employing fleets of Vehicles from various manufacturers, in particular the new International Airport in Kuala Lumpur, Malaysia, who have recently taken a fleet of vehicles from German manufacturer Albert Ziegler GmbH & Co. KG.

Based on the experience with those vehicles as well as with the others operating in various countries, quite a lot of new, revolutionary ideas have been incorporated in the latest products.

One of them is the Snozzle® technology which has been commented above; others are the introduction of Ziegler's unique superstructure in ALPAS®: a very rigid system of aluminium panels which give extreme stability to the crew cab although huge windows allow extreme viewing angles in all directions.

All electronic controls are managed by a CAN-BUS system and are fully automated so that the crews can concentrate on their most important job and do not have to care much about the operation of their equipment. Maintenance and service are eased and guarantee a smooth operation in case of emergency.

There is no doubt that constant training and exercise are necessary for the crews so that they can handle their equipment even under stress situations, but all the manufacturers try to as much as possible to make operation of these vehicles as simple as possible.

Even though it is important for the fire brigades, to have enough well trained staff available, some tendencies in reducing costs by reducing manpower seem to be very dangerous from the viewpoint of a travelling passenger. Further increase in air traffic must be connected with better safety standards. All equipment of the fire fighters must be adapted to the special needs in aircraft and airport fire fighting. Very often standard tools are not efficient enough and have to be replaced by special tools like extrication equipment, which must be applicable to aircraft.

The increasing risks due to the vast growth of industrialisation are guidelines for the future.

Many manufacturers have set up a network of agencies and partner companies all over the world, which has led to a close co-operation in many countries, thus guaranteeing the capability of a world-wide after sales service by authorised mechanics and service engineers.

In the Asia Pacific region a number of manufacturers have developed long lasting co-operation various partner companies which has led to the highly trained engineers to be able to build these vehicles to the highest standards. The production in these countries does not only cover the domestic market, but also prepare them for export into other countries in the Asia Pacific. Many of the components like fire pumps, foam admixing systems and monitors are manufactured in Europe and American and are shipped to the manufacturing plants.

Close and long lasting partnerships with companies in Thailand, Malaysia, Taiwan, the Peoples Republic of China, The Philippines, Vietnam, just to mention a few countries, keep the manufacturers updated to the specific needs of the region. Local production including European and American components are combined with imported high end products like airport fire fighting vehicles, which require internationally agreed standards, based on the recommendations of the International Civil Aviation Organisation (ICAO).

AIRPORT CRASH TENDER Z8 ALPAS

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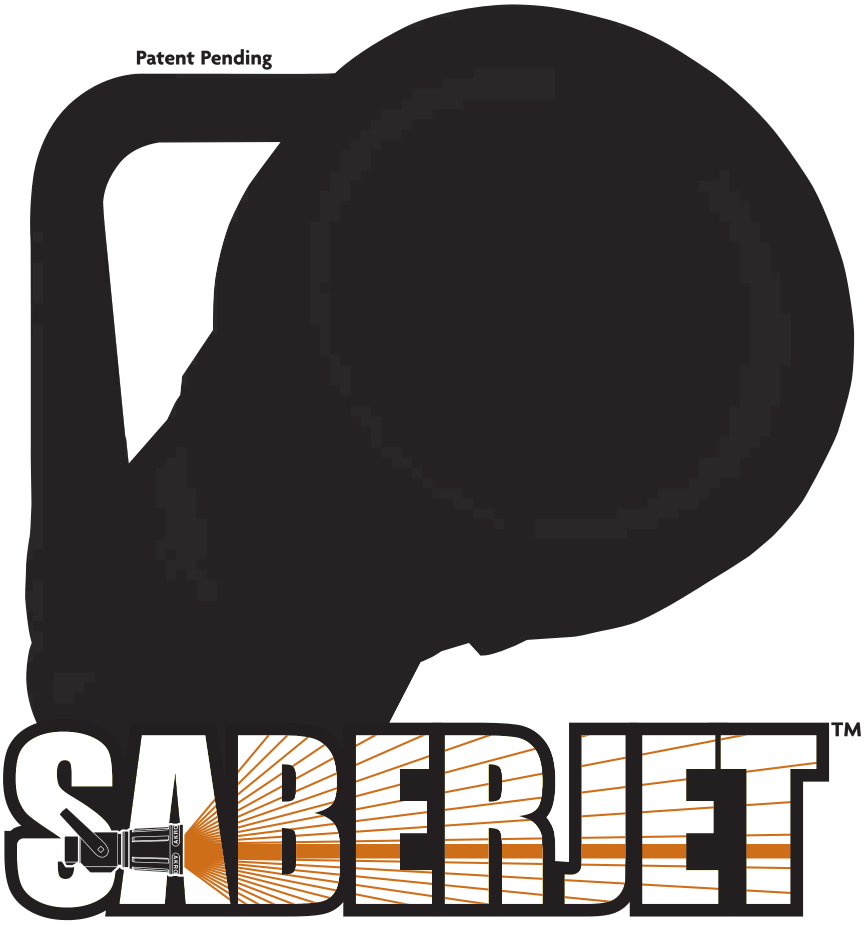

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— Straight stream & fog at the same time or separate
— 7 tip options - 9mm thru 25mm
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Large Capacity Monitors for Bulk Storage Tanks

By Mike Willson

Foam blanket of Angus FP70 projected onto the roof of a 20 metre high 65 m dia. open top floating roof tank by their Colossus 15,000 litre/minute monitor based 50 metres away from base of tank

BULK STORAGE TANKS are well proven as an effective and efficient way of storing large quantities of flammable liquids from crude oil to refined products like gasoline; and polar solvents like methanol and a whole host of complex solvent chemicals. The liquid held in one of the largest quantities is crude oil with a range of constituents each with their own boiling points, giving us a major headache when we are faced with a fire scenario, because of the risk of boil-overs.

Boil overs are a situation normally occurring in Open Top Floating Roof (OTFR) tank fires, when water and low boiling point constituents within the stored product reach their boiling point ahead of other layers nearer the surface. Upon boiling they massively expand into their gaseous phase forcing the hot and flaming liquids above, out of the tank in a boiling, frothing, explosive fire ball and cascading like a tidal wave of fire into the surrounding bunded area of this and other tanks nearby. Generally speaking the larger the bulk storage tank the bigger the problem!

Whilst fixed foam systems are the preferred and most effective method of protecting bulk storage tanks, there is increasing interest in large capacity monitors, which can be used on any of the tanks in the tank farm, so can be a cost-effective fire protection alternative.

HOW BIG IS BIG?

The largest OTFR tanks are between 90-110 metres (295-360 ft) in diameter. An amazing size to have fully involved and on fire!

Most readers have probably never seen a major storage tank fire. They are awesome in the noise and radiant heat generated, the size of fire plume and smoke pall, as well as their ability to create their own artificial winds by sucking air in from the surroundings to feed the fire surface and sustain ignition – and that is well before a boil-over!

But it is precisely at this point that we must not panic!

OPTIONS AVAILABLE?

There are 3 basic approaches or options when it comes to fighting these large fully involved tank fires, bearing in mind that probably around 95% of all OTFR tank fires are rimseal fires which are efficiently extinguished by fixed rimseal pourer systems, or occasionally even hand lines and not large monitors, which could not target the small rimseal area with foam but tends to flood the whole roof with foam, risking a flip over or sinking of the roof which could cause a full surface fire.

Large $400m^2$ fire quickly extinguished by Angus Fire's Colossus aspirated cannon and FP70 foam

Large Capacity Monitors for Bulk Storage Tanks

1 A fixed foam full surface system is the ideal protection for every large storage tank, in addition to its existing Rimseal foam pouring system, to have an extra dedicated fixed foam pouring system capable of covering the whole surface area quickly with an aspirated foam blanket. Medium expansion FluoroProtein foam could provide the optimum balance of quick flowing across the surface and adequate stability to resist re-ignition. Unless there is only one very large tank, this is unlikely to be the most cost-effective solution, considering the risk of full involvement is quite small providing effective rimseal foam pourers are already installed).

2 Non-aspirating mobile monitors seem to be a popular current application method (supplementing rimseal pourer systems), which can be moved and set up around whichever tank has the problem. This system involves the use of "non-aspirated" foam attacks using detergent based AFFF type foams when film formation does not occur on very hot fuels and these foams drain down quite rapidly! AFFF type foams were never designed for tank fires but aviation spill fires, so they have been replaced by the more expensive and difficult to handle AR-AFFFs, which were originally designed for the more aggressive polar solvent fuels, but some products are now formulated primarily for their hydrocarbon performance and can struggle to extinguish a polar solvent fire! These foams are used in some areas as an expensive way to mimic the advantageous qualities of a good quality FP foam like FP70.

3 Aspirating trailer based monitors. These large capacity Aspirating monitor systems provide specially designed colossal foam cannons which enable a well formed, stable tight stream of low expansion foam bubbles to be produced and thrown an equivalent distance to similar sized non-aspirated nozzles, but with less fall out, better stability and post fire security characteristics. These units work well with a wide range of foams particularly FluoroProteins like FP70 and AR-AFFF/AR-FFFPs.

SIMPLE AUTOMATIC DETECTION

Consideration of a simple linear heat detection system can provide additional automatic monitoring & activation of such a system, day and night for 365 days each year.

LARGE CAPACITY MONITOR SYSTEMS

These large capacity monitors whether aspirated or non-aspirated, start at around 15,000 l/min flow (4,000 USGall/min) and go up to 40,000 litres/min flows (10,000 USGall/min) or even more!

The key to success with these big monitors is not just the monitor at the end of the line but the whole operating "System". Simplicity and reliability are essential requirements of this system approach.

Huge water supplies at quite high pressures are needed to feed these monitors. Separate large capacity pump sets and extra large diameter hose (XLDH) systems up to 12″ diameter on dedicated reelers, can be a more cost effective solution than trying to upgrade permanent steel piped ring main systems to enable such massive flow withdrawal at the numerous points required around the tank farm.

WHICH MONITOR ROUTE TO CHOOSE?

There are generally two types of monitor package in use. Firstly the so-called "big guns" with non-aspirated or semi-aspirated mushroom type nozzles, which claim to throw furthest (90-100 m). However the resulting foam produced tends to be less stable and a more variable expansion foam blanket which is more likely to pick up fuel as it plunges into the hot surface layers of the fuel, take longer to extinguish, break down faster and hence have more difficulty preventing subsequent re-ignition. This type is reliant on up to 10 x 125 mm (5″) diameter supply hoses and around 8 separate jet ratio controller type inductors all gobbling expensive AR-AFFF foam – and only one brand is recommended!

Most recently users are being encouraged to use a 1% shear-thinning polymer containing AR-AFFF foam, which will be extraordinarily difficult to maintain at 1% throughout the incident. The international standard guidelines for induction accuracy at 1% settings is just 1-1.25% which is difficult to achieve with a standard 1% AFFF never mind a viscosity changing polymer containing AR-AFFF! Just a small reduction of accuracy down to 0.75% could jeopardise success of the whole attack, as sufficient concentrate may not be delivered into the foam arriving at the fire. At the other end of the "knife edge" a small over-induction every minute and the monitors could run out of foam – before the fire is fully extinguished! Either way it is likely that a prolonged fire attack will be required. Although operating with 3% concentrates mean the foam tanker logistics are more complex, 3% induction is far more forgiving of minor induction inconsistencies during the

Angus Fire's 40,000 litre/min MEGA Colossus aspirating cannon monitor, capable of delivering a stable FP70 foam stream long distances onto large diameter floating roof tanks

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Large Capacity Monitors for Bulk Storage Tanks

attack, which is reflected by the international standards for acceptability at 3-4% for a 3% setting.

Users are also encouraged to fly in experts from afar to supervise operation of these units.

Hydraulically controlled Angus FETCH compact Hi Vol deployment and retrieval system, built into a vehicle mounted pod system capable of storing and rapid deployment of over 1 kilometer of 5″ or 6″ Hi-Vol fire hose

COLOSSAL CANNONS?

The alternative is the colossal cannon approach with a specialised aspirating foam barrel designed to control and optimise foam quality with a well-formed bubble structure producing a longer drainage time so it will flow across the surface, cool and seal against hot edges. This foam last longer to provide the all-important post-fire security to avoid the worst outcome – the risk of a major re-ignition when all your foam stocks have been used up fighting the fire once already! Having got it out, we MUST be able to keep it out! This cannon approach is designed to deliver the best attributes of your foam for tank fire fighting, whilst still enabling the foam to travel around 90 metres (300 ft) ground-to-ground distance at 7-8 bar g. This is a more recent development and has carefully focused on user needs, enabling use along narrow roadways, enabling tank attack at 90° to the towing direction yet keeping the logistics as simple as possible so that refinery fire crews can easily and quickly set up the whole system themselves with minimal personnel involvement. They can now effectively tackle their own fires without expensive and sometimes contradictory inputs from elsewhere.

Only 4 people are required to set up and operate the whole aspirated monitor system. The first team member controls the main water supply pressures, another the foam stocks & single jet pump foam inductor or dedicated diesel driven foam pump, a third operates the cannon and the fourth is spotter and coordinator to check the foam trajectory reaches the tank effectively.

This is possible because these colossal cannons just have a single foam induction point (which can be located up to 100m away) to feed cost effective 3% FP foam (but other foam types can be used) directly to the monitor cannon inlet. Bulk foam reserves can then be held in a safe area to facilitate relaying for longer periods if necessary.

This minimises foam wastage and allows the foam line to be charged against a shut-off valve whilst the delivery hoses are getting up to pressure so valuable time and foam is not wasted ahead of the foam attack. Combined with as few as 2 large diameter 150 mm (6″) high volume water feed hoses for 15,000 litre/min flows, pressure losses at the cannon are minimised whilst line pressures at the monitor optimised and faster water delivery to the foam cannon is achieved. Foam can also be introduced into the suction side of the pump to minimise pressure losses and further simplify logistics by having foam stocks marshaled around the main pumping point, so foam solution is pumped directly to the aspirating monitor avoiding the need for a separate foam line to the monitor.

Time is also saved as far fewer hoses need to be laid out and the monstrous pressure losses that can occur from the spaghetti effect of numerous smaller 2½″ diameter hoses can be avoided completely.

It has to be said that the risk of a fully involved surface fire is very small, especially if the best preventive

> *Combined with as few as 2 large diameter 150 mm (6″) high volume water feed hoses for 15,000 litre/min flows, pressure losses at the cannon are minimised whilst line pressures at the monitor optimised and faster water delivery to the foam cannon is achieved.*

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Single jet pump inductor feeding the Colossus aspirated cannon monitor with FP70 foam from a vehicle tanker

maintenance procedures are adhered to for each tank, non-flammable seal materials are installed and effective fixed rimseal pourer protection and linear heat detection system are fitted, BUT when they do happen – and they are usually caused by lightning strikes – they can cause rapid escalation, if not devastation of the tank involved. Worst of all the entire facility is placed at risk and business interruption costs, adverse publicity costs, re-building costs begin to spiral upwards.

HANDLING LARGER HOSES?

Clearly it is more difficult and potentially hazardous with risk of back injuries for fire crews to be carrying long lengths of 125 mm or 150 mm hoses. 70 mm hoses are challenging enough over long distances!

The simplest and easiest modern way of handling larger diameter hoses for either type of monitor approach is to use a fast and efficient technique for collecting (and deploying) these high volume hoses.

A range of systems is now available, but some are unduly complex with electronic gadgetry everywhere, whereas the simpler and more compact units operate with a hydraulic power pack and come as a pre-built module to fit locally onto a suitable vehicle. This could be a new build vehicle dedicated to the purpose or a more cost effective route is to fit the module onto an existing truck ready for a change of use.

These systems will rapidly deploy the ready coupled hose from the truck at the start of the incident so the monitors can be brought swiftly into action, and will drain and pick-up the hose afterwards so it can be relayed into the truck ready for the next emergency. Again this task can be done without strain to already tired fire crews and requires only 3 people to operate including the truck driver.

These deployment/retrieval systems are not restricted to use with the larger diameter hoses only, they can also be used to deploy and retrieve the standard 65-70 mm diameter hoses as well if required. A wide range of coupling types can be used with this type of equipment.

For longer distances of a kilometer or more, 250-300 mm (10-12″) diameter lay flat hoses are now available with reelers, large pump sets and a full range of connection hardware to minimise pressure losses and provide rapid

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deployment anywhere in the refinery or tank farm.

THE IMPORTANCE OF RIMSEAL FOAM PROTECTION

Fires in these large tanks usually start in the seal area and since many seals are still made of flammable materials they can develop swiftly along the seal. It is therefore important to protect this seal area with an efficient rimseal foam system to minimise the risk of escalation. The rimseal system will exclude oxygen by smothering the fire; cool the seal material, fuel and metalwork, and produce a fluid yet stable foam blanket capable of resisting fuel pick-up and preventing re-ignition.

> *The rimseal system will exclude oxygen by smothering the fire; cool the seal material, fuel and metalwork, and produce a fluid yet stable foam blanket capable of resisting fuel pick-up and preventing re-ignition.*

CONCLUSIONS

Care should be taken when selecting large capacity monitors for bulk storage tank protection, as it is the overall system that will make the difference between success and failure. Quickly deployed 150 mm diameter hoses with appropriate storz outlets fitted to the ring main system – or even XLDH hoses for longer distances – with minimal hose inlets at the monitor, reliable single point 3% foam induction, cost-effective FP foam storage in road tankers and an aspirated foam cannon delivering the optimum quality foam to combat the ravages of a hydrocarbon storage tank fire will provide the essential post-fire security required to be able to declare a successful end to the incident.

Angus Fire's Unimog all terrain Firekat 2 retrieval and deployment system in use with 5" Hi-Vol hose

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Aircraft Rescue Fire Tra

Picture courtesy of IFTE

There is also increasing concern over the environmental impacts arising from pollutants emitted by aircraft engine exhausts. Kerosene is the main component of aviation fuel, which is used to provide propulsion for current commercial aircraft. Like other fossil fuels, kerosene produces carbon dioxide and water vapour as the products of complete combustion. The pollutants of concern are the emissions of nitrogen oxides, carbon monoxide, hydrocarbons and soot. Emissions limits from aircraft engine exhausts have been defined for these pollutants by the International Civil Aviation Organisation (ICAO).

The innovation and the development of aircraft live-fire training simulators meet the growing need for realistic training of the emergency services and act in response to the rising environmental concerns pressure at the airports. There are only few companies in the world that offer this type of training equipment for airports. Although not yet commonplace, aircraft fire training simulators are now in place at major airports in the UK, Germany, The Netherlands, Scandinavia, Canada, USA, Japan, Hong Kong and Singapore.

THE AIRPORTS AROUND THE WORLD are being used more intensively and the people are becoming more and more conscious about their safety. As the risks associated with this development increase, so too does the importance of effective disaster relief. The principal objective of the Airport Rescue and Firefighting Service is to save lives in the event of an aircraft accident or incident. Exercises are crucial in this. Fire is widely considered to be one of the most dangerous risks and therefore there is an acknowledged need for realistic fire training. The International Civil Aviation Organisation (ICAO) recognises that knowledge and training are fundamental elements in fire safety management and planning. Realistic training is a key element in giving people the necessary skills to manage risk and develop a safer working environment.

The market leader in the provision of aircraft fire trainers is the UK-based company IFTE, which has an international presence through its numerous subsidiaries (Symtron Inc, USA; ICS, Canada; ICS France; Symtron GmbH, Germany) and installations. The company specialises in designing and manufacturing

Emergency situations happen daily when people least expect them. Training people to react in the correct manner and ultimately save lives is vital. Realistic training is a key element in giving people the right tools to manage situations that may occur in their environment.

IFTE develops training simulators to suit all needs, from Fire Extinguisher Training Equipment for people in the workplace to sophisticated training grounds around the world . IFTE simulators ensure that training is realistic, safe, reliable, economically and environmentally acceptable.

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fire-training simulators for a broad range of international market segments, from Fire and Rescue Departments, International Airports, through to Special Forces. Its simulators enable clients to meet increasing regulatory and legislative requirements and are used on many different levels, helping to train professional emergency personnel through to employees within industry and commerce. With over 400 installations worldwide and with over 30 international patents, IFTE's technology meets the demand for fire fighting in the most real and challenging of situations. Virtually any aircraft crisis including all aspects of Incident, Command and Control can be created simply and safely at the touch of a button. IFTE's Civil Aircraft Simulators are designed to suit any size or category of airport. All fire simulators operate by combining propane and water, so allowing complying with the Environmental Protection Act 1990. IFTE is the only company in the world with the capability to design and manufacture the largest aircraft fire trainer mock-up, a Boeing 747.

The largest aircraft-training simulator in the world is at Schiphol International Airport. The rig dimensions are…

Length: 52.6 metres
Wingspan: 29.7 metres
Height: 14 metres
Weight: 250 tonnes

This is the world's most advanced aircraft accident simulator that has been installed at Schiphol Airport, Amsterdam by IFTE to provide state-of-the-art training for airport fire crews. IFTE has developed a full-size mock-up of a Boeing 747. The detailed interior and exterior of the 747 Simulator can create an impressive 26 different fire scenarios including a high tail engine fire; broken wing and engine fires, LPG fuel spill. The simulator is fitted with a high engine to represent an MD-11. This simulator can successfully recreate any situation that Airport fire fighters may encounter. All fires are fueled by LPG Propane, a safe and environmentally acceptable alternative to conventional carbonaceous or hydrocarbon fuels.

Fuel spills areas are located either side of the aircraft fuselage and cover an impressive 864m^2 and are capable of reaching a height of 10 metres! The fuel spill area is driveable, allowing fire-fighters to position vehicles correctly, thereby experiencing the full realism of an emergency situation.

The Control Room monitors each exercise, from galley oven fire to large-scale engine fire. Located on the Training Ground, the Control Room uses the latest in PLC system software giving instructors control over training exercises.

Benefits to Schiphol – a spokesman for Schiphol Airport explained the benefits of the rig are:

1. Standardisation: all fire crews tackled incidents properly before we had the rig but in their own way; now techniques are harmonised through discussion amongst the teams – we have for example developed exercise duties and great progress is being made.

2. Efficiencies: because we previously had to spend a lot of time in preparation we can now spend a lot more of our time in actual training; previously it could have been as much as 2 to 3 months between exercises. Debriefing is so much more effective and is helping to develop future professionalism.

3. Records: these help us understand previous experience and plan further development.

4. Morale: we actually enjoy training on this rig; good positive feedback helps build morale and confidence!

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Picture courtesy of IFTE

5. ICC (Incident Command and Control): Exercise design helps us arrange incidents with other incident response partners and this develops overall ICC skills.

6. Environmental: IFTE design is a considerable improvement as previously Kerosene was set alight all over the fire ground surface.

Other smaller companies with the ability to manufacture aircraft fire trainers include the UK-based companies Simulation (TERS) Ltd and Process Combustion Ltd, the Canadian Pro-Safe Fire Training Inc.

Simulation (TERS) has already seen some remarkable successes, including hot fire civil aircraft simulators for Birmingham International Airport, East Midlands Airport and Bournemouth International Airport and a multi-purpose military aircraft simulator for the Ministry of Defence (MoD); the latter believed to be the largest hot fire training simulator within the MoD.

Simulation (TERS) is unique in Britain in both designing and manufacturing in-house. Simulation (TERS) offer turnkey projects from inception through design, development, construction, installation and commissioning. They also provide after sales service, including planned preventative maintenance, for its own and for other manufacturers' equipment.

Simulation (TERS) rigs are built with robust steel shells and internal chambers designed to simulate conditions within an aircraft, with, for example, bulkheads, seating, galleys, toilets and including hatches and emergency exits for search and rescue exercises.

One of Simulations (TERS) biggest contracts was for a Boeing 767 to be installed at Copenhagen Airport. The simulator was manufactured at their manufacturing facility in Burton upon Trent, England. The rig was then transported by ship to Copenhagen. Simulation direct employees then traveled to Copenhagen Airport to install and commission the facility. Steve Fahey, Managing Director, states "This is very important project for us. It has strengthened our position in the international area and provides us with a high quality product reference point in Scandinavia. It was a particularly demanding project in view of the timetable, but we are pleased that we have been able to achieve all of the targets set by our client, particularly time and cost." In the International Airport arena Simulation TERS Ltd were awarded the contract to provide a Boeing 767 Fire Training Simulator to Airport Fire Service at Copenhagen Airport in Denmark. The contract was awarded by Copenhagen Airport in early September 2002. The contract involves the supply of a Boeing 767 Aircraft simulator with a total of 16 external pressure fed kerosene fires located around the engines, undercarriages, under wing, fuselage and nose wheel. The simulator was delivered to meet a very fast track programme and commissioning took place on the 20 December 2002.

> Airport personnel face ever-increasing challenges in today's world. Firefighters know they may be called to respond to aircraft accidents and situations resulting from terrorist activities. Realistic training gives people the tools to react to a crisis in the correct manner and ultimately to save lives.

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Located in Makati city in the Philippines, the Power Plant Mall is a four-level shopping center designed to provide a uniquely carefree and convenient shopping and entertainment experience. One of the reasons the experience can be so carefree for visitors is the facility's attention to safety, and particularly fire safety.

Protecting a mall of this size is not the easiest of tasks. Over 120,000 square meters large, the $50 million mall is home to 250 stores including a large supermarket, various restaurants, multiple cinemas, and an enormous underground parking garage that can house 2000+ automobiles. The generous garage is one of many features designed to provide mall guests with “quick-in and quick-out” convenience. The sheer size and extraordinary amenities of this mall all work to differentiate it from the smaller, more cramped and less “user-friendly” shopping centers in the Manila area.

To find a system to protect the mall's occupants and guests from fire, the facility's owner, Rockwell Land Corporation, turned to Yek Yeu Merchandising, an established fire alarm distributor. After carefully evaluating the Power Plant's unique goals and requirements, Yek Yeu recommended a fire safety system from NOTIFIER, the world's largest manufacturer of engineered alarm systems.

According to Peter Chua of Yek Yeu, “NOTIFIER has a strong record of reliability and quality compared to its competitors. The flexibility of NOTIFIER software allows the distributor to create a program that is most suitable to the retail mall requirements for monitoring and control.”

Yek Yeu installed a network of six AFP-400 intelligent fire alarm control panels. The network includes two Intelligent Network Annunciators (INAs) that are used to monitor and display information from the entire network on an 80-character display and control keypad. The system also includes a Network Control Station (NCS), which monitors and controls the system in a graphical format on a Windows®-based PC.

“In a building this large, a wasted second can be life-threatening in an emergency,” said Peter Chua. “We really needed a system that lets us locate with pinpoint accuracy the exact place in the mall where the fire alarm is sounding. With the NOTIFIER system, we can accurately provide fast, remote fire protection to every section of the facility.”

The NOTIFIER system delivers the necessary level of coordinated annunciation and response for large operations like the Power Plant Mall. With this fire system network, each fire alarm control panel maintains its own area of protection, while monitoring and interacting with other panels. All the nodes, remotely linked to the fire alarm control panel, react to network events with coordinated programmed responses.

“We greatly appreciated the fact that each panel could operate independently from the rest,” said Angela Bella of Rockwell Land Corporation. “So if one panel breaks down, we wouldn't have to worry about all the other links in the chain.”

Along with providing command center operators with network control and panel programming, and clear, accurate system information, NOTIFIER's Network Control Stations interface with the building's public address paging system. It communicates network events and provides individual control of network points or nodes. So the command center operators can quickly obtain a complete grasp of the situation and relay proper voice instructions through the building. Operators can also remotely manage airflow and smoke extraction, as the system is interfaceable with other facility controls. Fast installation was also of extreme importance to the mall's owners because any delays in the opening of the Mall would be extremely costly. So the system's minimal wiring was a big plus. In fact, the NOTIFIER system utilized only one small-gauge twisted pair unshielded wire throughout the system loop.

The Power Plant Mall is proud to offer its visitors one of the most complete and accessible shopping experiences in the area. And with the installation of the NOTIFIER's advanced fire safety control system, they can also be sure their shoppers are receiving the best fire protection possible.

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Compressed Air Foam Systems for Wildland Firefighting

By Dominic Colletti

Picture courtesy of Hale Products, Inc.

THE USE OF COMPRESSED AIR FOAM SYSTEMS (CAFS) for wildland firefighting has undergone extensive research and development in the United States and Canada. The advantages of CAFS for fire knockdown and mop up are strongly advocated by forestry agencies since the technology is well suited for suppressing the wide range of fires encountered in complex and demanding wildland terrain.

How do CAFS work? Simply stated, CAFS utilize a compressed air source, usually from an air compressor installed on the apparatus, that is piped in downstream from a foam concentrate proportioning system. Compressed air is then injected into a 0.5% Class A foam solution mixture. As both move out of the apparatus and into the hose line, a phenomenon called 'scrubbing' occurs. The scrubbing action produces small, tightly packed bubbles that characteristically have much longer drain times than foams produced by air aspirating nozzles.

Picture courtesy of Hale Products, Inc.

Why are today's fire officers researching the technology and purchasing CAFS apparatus? This is because wildland crews using CAFS have compared its use to plain water and have documented significant fire suppression improvements. They have found that the addition of an air compressor, while increasing the cost of a fire truck, provides additional firefighting capabilities that more than offset the cost. For example, the benefits of CAFS for wildland firefighters include reduced labor that's required during direct fire suppression and mop up, increased productivity of a fire apparatus' water supply, and stress reduction when advancing CAFS hoselines that are approximately 50% liquid filled by volume.

What are the major features and benefits of using CAFS generating Class foam during wildland firefighting for the fire officer?

Various foam consistencies. Using compressed air to generate the foam bubbles allows the fire officer to produce various foam consistencies that best match a particular fire challenge.

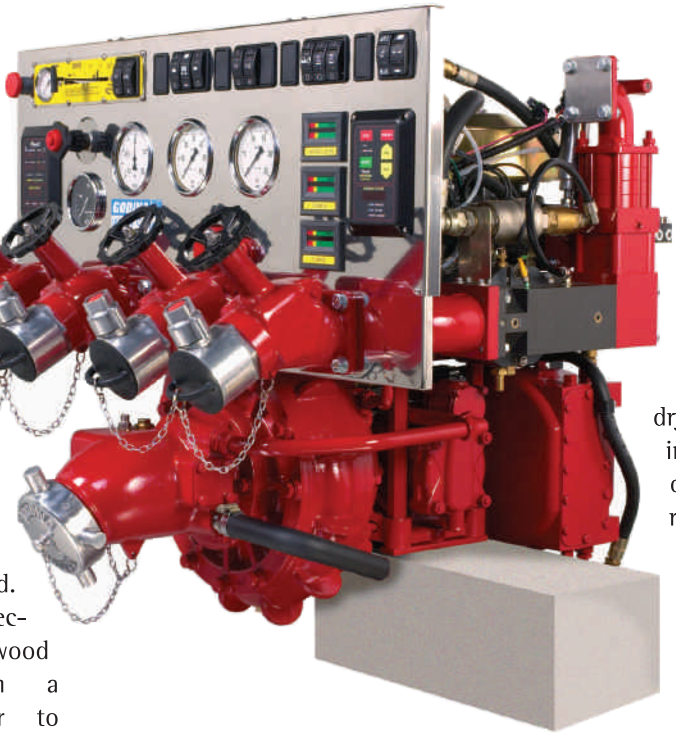
For example, a wet, quick-draining low expansion foam is ideal for direct attack of a running ground cover fire. Upon application, the foam blanket hits and clings to fuels. The finished-foam blanket – which is made up of mostly water – either evaporates or drains out onto the fuel surface. The foam solution contains surfactants (surface acting agents) that spread out over the fuel, cooling and penetrating the surface. This acts to raise the moisture content of the fuel. The result? The water

Picture courtesy of Hale Products, Inc.

applied (as a foam blanket) has superior cooling, which means quick flame knockdowns as well as fuel moisture retention that inhibits re-ignition.

It has been found that compressed air foam allows approximately 90 percent of the extinguishing agent to remain on fuel surfaces rather than run off. This greatly extends the use of limited water supplies.

A dry, shaving cream type foam consistency can also be produced. This is best used in exposure protection situations. Dealing with wood sided dwellings located in a wildland/urban interface, prior to arrival of a running wildfire, one tactic using CAFS is to coat the building with a wet, runny foam consistency, and then apply a "cap" of dry, cream-pie foam. The dry foam has a much longer drain time and effectively seals the wet layer to prevent moisture evaporation. The objective is to keep as much moisture in contact with the fuel, for as long as possible. This will effectively raise the fuel moisture content. With fuel moisture increased, the dwelling surface has a better chance of resisting ignition since it will now take much more heat to raise the surface to ignition temperature during the overrun of a wildland conflagration.



Picture courtesy of Hale Products, Inc.

In some tactical fire suppression situations, the air compressor may need to be turned off, and only the foam proportioner activated.

For example, in situations where there is extremely deep-seated fire, a wet-runny non-aspirated Class foam solution is the best choice. A stubborn muck fire found on dry lakebeds consists of the incomplete decomposition of organic materials, mostly plant residues. Muck can be found on lake bottoms in layers from several inches to several feet in depth. When a muck bed burns, non-flaming combustion is found inches, maybe even feet down from the surface. A smoothbore branch nozzle applying Class A foam solution (with no compressed air) is the best choice for fire extinguishment.

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More compact and lightweight CAFS module designs now make retrofitting the technology on existing fire apparatus easier than ever before.

using CAFS. The hydraulic energy that normally propels the fire stream is supercharged with the additional energy of compressed air. The fire stream exiting the nozzle has hydraulic and pneumatic energy propelling the finished-foam up to 30% further in distance, as compared to a normal hydraulic fire stream. This provides greater stream reach to stop fire in tall tree canopies and brush that is ordinarily out of reach of plain water streams and allows firefighters to attack longer flame lengths without being subject to intense heat and smoke.

Lightweight hose. Since the hoseline is filled with approximately 50% air by volume, one person using only one hand can move several lengths of charged CAFS hoseline. With less weight, advancing hose through difficult forest terrain becomes much easier and less stressful for fire crews. Additionally, friction loss is lessened when dealing with long hoselays that are required when the fire is located many meters from an apparatus positioned at a roadway. The elevation pressure loss of compressed air foam in a vertical hoseline is much lower than water. When a line is stretched up a mountainside, much less pressure is needed at the base in order to move the finished-foam up to the elevation of the nozzle.

More compact and lightweight CAFS module designs now make retrofitting the technology on existing fire apparatus easier than ever before. A CAFS pumping module can cost approximately from 5% to 10% of the total cost of a new fire truck. A lot of money, say you? When considering the increases in firefighter safety and firefighting capability, the dollar value pales in comparison.

What's stopping your brigade from investigating CAFS? There are several books on the subject and training and education programs that are also available. These are good places to start investigating the technology for its application in your fire district.

Dominic Colletti is the global foam systems product manager for Hale Products and a Fire Service Instructor. He has trained fire brigades around the world on the application and use of compressed air foam systems for both wildland and structural firefighting. Having over 17 years experience in the research and development of CAFS technology, Dominic's lesson's learned are highly valuable for brigades that either desire to improve their current use of CAFS, or are considering the use of the technology for the first time. He is also the co-author of *Foam Firefighting Operations 1*, with Larry Davis. Dominic can be reached at: dcolletti@haleproducts.com

Picture courtesy of Hale Products, Inc.

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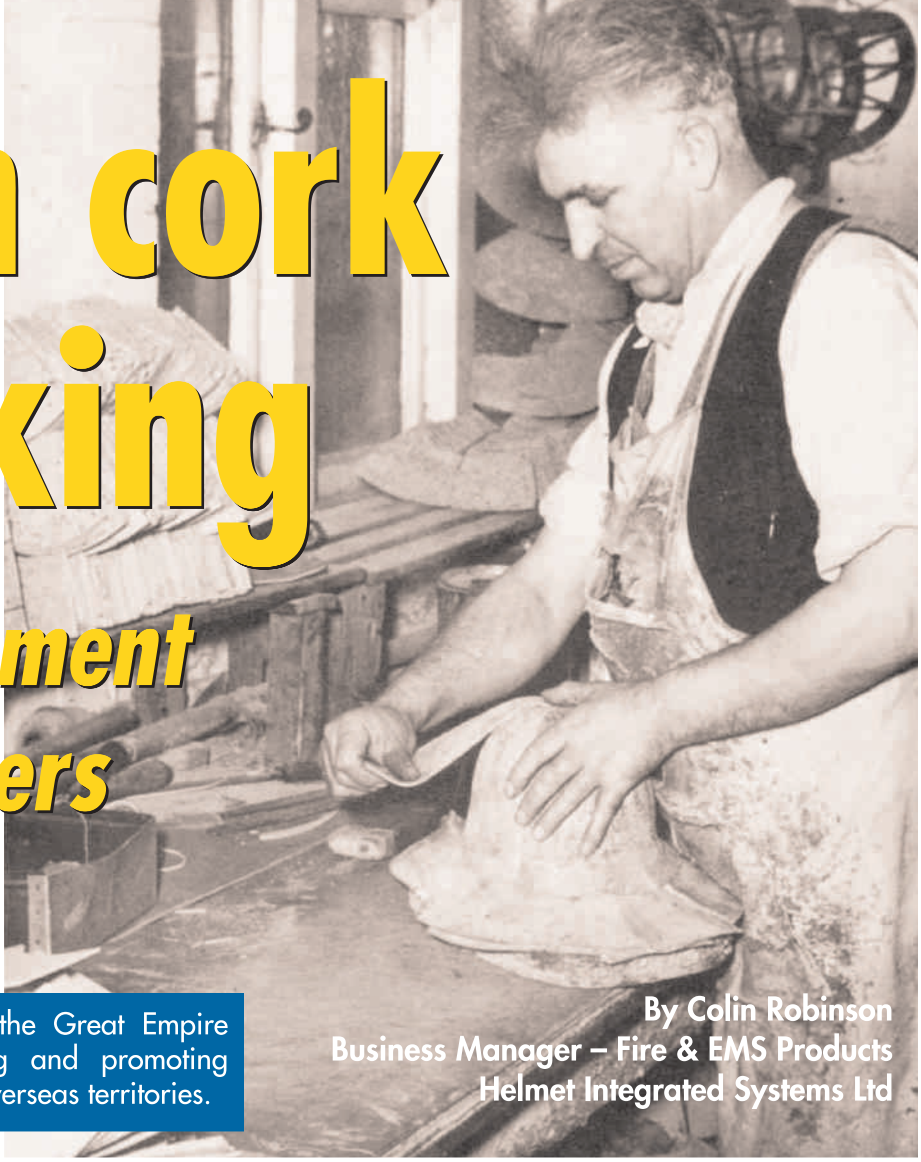
When cork was king

The development of fire-fighters helmets

In 1926 King George V opened the Great Empire Exhibition at Wembley celebrating and promoting British achievements throughout its overseas territories.

By Colin Robinson
Business Manager – Fire & EMS Products
Helmet Integrated Systems Ltd



A tropical helmet being hand crafted from cork sheets with layers glued together to provide a strong, lightweight laminate

Established less than 2 years before this date, a little known company called Helmets Ltd., forerunner of the leading British helmet manufacturer in existence today, exhibited its products. Chief amongst these and a world-wide top seller was the Topee – a tropical helmet hand-made from cork and the regulation headgear for British administrators, police and soldiers living and working in the colonies.

At this time miners went down the pits in cloth caps, motorcyclists rode around bareheaded and firemen raced to a blaze in helmets of shining brass.

Head protection in any real sense was virtually non-existent and in the pre-plastic age, helmet makers relied almost exclusively on cork, vulcanised rubber and cotton twill bonded with resin as their materials of construction.

Nowadays materials and processes have been developed including Glass Reinforced Plastic (GRP), Acrylonitrile Butadiene Styrene (ABS), Polycarbonate, Carbon Fibres and thermoplastic composites. Processes include automated vacuum assisted pressure bag moulding and resin transfer assisted moulding (RTM). These materials and manufacturing techniques are used to make fire-fighters helmets that combine high strength protection against impact and penetration combined with lighter weight, improved wearer comfort and greater fire retardancy, verified by rigorous testing to recognised international standards.

Back in the 1920's however cork remained king and the Topee's individually hand crafted construction of layers of cork sheets cut and glued together formed the basis of what was to succeed the traditional brass fire-fighters helmet.

An example of one of the first fire-fighters' helmets to be fitted with a face-shield – specified originally for airfield duties

Brass though imposing in appearance offered no practical benefits, being heavy and cumbersome to wear with no ability to absorb or cushion impact blows. There had also been at least one fatality – an electrocution which was attributed to the helmets metal construction.

A turning point in the development of the fire-fighters helmet and the fortunes of Helmets Ltd came in 1935 when London County Council asked the British manufacturer to submit a prototype to their fire department to replace its existing brass helmet.

Using its tried and tested cork construction the company presented the LCC with a new helmet that was much lighter and more comfortable to wear and for the first time offered some real protection from impact and heat due to the inherent resilience of the layered cork material.

As an added incentive the new helmet had the distinction of having been

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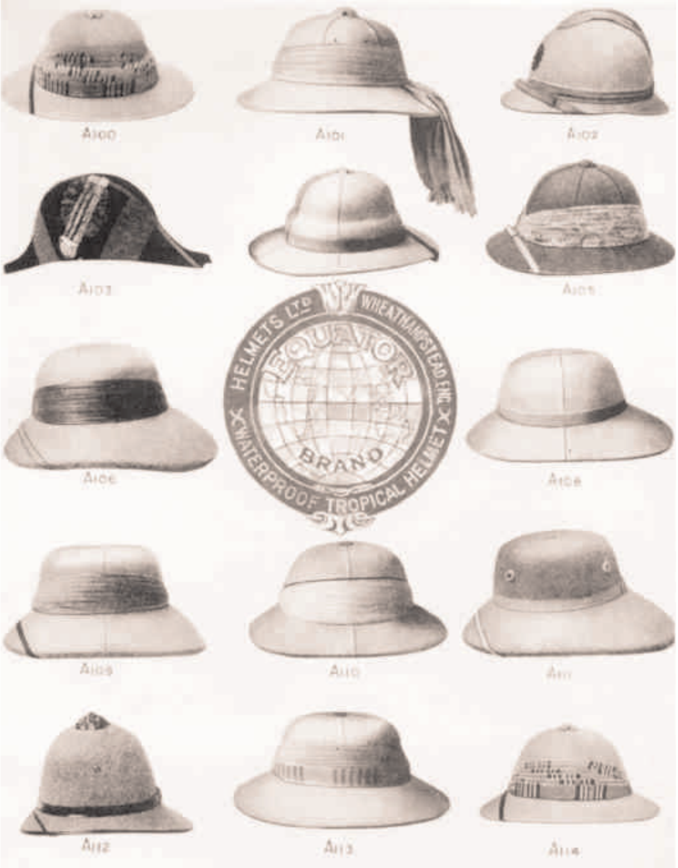
designed by Sir William Reid Dick one of the most distinguished sculptors of the day.

The contract for around two and a half thousand helmets that followed the approval of the cork prototype set the seal on what was to become a standard specification for fire-fighters helmets lasting up until the introduction of new materials in the 1960's.



The Topee tropical helmet made from cork, worn throughout the territories of the British Empire and the forerunner of early fire-fighters' helmet construction

Traditional hand crafting of cork from flat sheets, a slow and expensive process, became superseded by the development of a simpler and quicker production method using fragments or 'crumbs' of cork bonded with resin. This enabled up to 250 helmet shells to be produced in the same time it would have taken to make 50 of the handcrafted originals. This heralded the demise of traditional helmet making and the move towards streamlined manufacturing and assembly.

With the arrival of GRP and ABS plastics cork finally began to lose its popularity. The drive towards more rigorous standards of protection, reinforced by new European standards and the demand by Brigades for improved wearer comfort and lower through life costs accelerated this process.

Face protection had also become an important priority in fire-fighting leading to the introduction of face-shield systems made from materials such as polycarbonate that could resist high velocity impacts and protect against radiant heat.

Today's fire-fighting helmets have also changed their shape from that of the traditional wide brimmed style with the central comb.

A greater recognition of the need for access and manoeuvrability in confined spaces led to a departure from this traditional style to helmets whose shape is closer in appearance to those worn by star troopers in popular sci-fi movies.

A greater emphasis was also placed on the need for increased wearer-comfort and hygiene, reflecting the preferences of individual fire-fighters which were increasingly addressed through trials carried out on different types of helmet, prior to purchase.

An early fire-fighters' helmet being moulded from the cork crumb and resin mixture which superseded the traditional cork sheet method

With developments in fire-fighting techniques and the specialisation of tasks the helmet became more than just a head protector – it provided a base for the attachment of additional fittings such as torch brackets and integral covers to protect the surface of retracted visors.

Another development in helmet technology was fuelled by the demand for improved communications between individual members of fire-fighting teams, particularly in operational conditions where conventional radios often prove to be ineffective, for example in areas of high ambient noise in confined underground spaces, within complex building structures and below decks on-board ships.

To answer this need another step forward came with the introduction of a helmet and face-shield system with its own built-in, cordless duplex radio, integrated into the rear of the helmet shell and capable of allowing communications between up to 16 separate fire-fighting teams.

This novel helmet with its improved communications capability was tested by the UK Ministry of Defence in trials carried out by Royal Navy fire-fighters to determine its effectiveness for shipboard use. The successful conclusion of these trials led to its use on board the UK Royal Navy's surface vessels and in submarines for fire-fighting and damage control duties.

From the cork Topees of our imperial past and the shiny brass show-pieces of yesteryear we have now arrived at a point where we can equip single fire-fighters, their Team Leaders and Controllers with a helmet that enables them to maintain constant hands-free two way communications with over a hundred other individuals.

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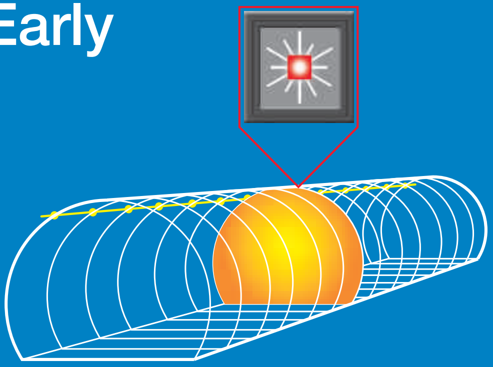

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Is Your Tunnel Protected Against Fire?

By Ian R. Holt
Regional Technical Manager,
Promat International Asia Pacific

Aftermath of Channel Tunnel Fire, England/France

FIRES IN TUNNELS are a major hazard to human life and cause costly damage to the infrastructure. The limited escape facilities and the difficulties encountered by intervention forces in gaining access call for extensive safety arrangements, which must be complementary and mutually coordinated.

Tunnels and underground transport facilities are important means of communication, not only in terms of shorter journeys, but also increasingly out of consideration for the local population and the environment. Generally speaking, important underground transport links are expected to be available without any restrictions and to operate smoothly round the clock. Interruptions due to accidents, technical malfunctions or maintenance work quickly cause traffic jams and delays, and figure in transport policy statistics as economic losses.

Rising traffic densities and the growing demand for underground communication links result in a higher probability of accidents, injuries and damage. Added to this are other factors, which increase the potential hazards of traffic tunnels:

- The increasing length of modern tunnels
- The transport of hazardous materials
- Two-way traffic (with undivided carriageways)
- Higher fire loads due to growing traffic volumes and higher loading capacities
- Mechanical defects in motor vehicles

When considering a tunnel(s), it is usually in relation to road and rail infrastructure, however, use of the word tunnels can be slightly misleading, as the following apply equally to pedestrian walkways, underground rail stations, underground car parks etc, in fact, to any concrete structure.

It is usually assumed that because a structure is constructed using concrete, that it is inherently fire resistant, and therefore requires no additional fire protection measures to be taken. Unfortunately, experience over the years has shown that this is not necessarily the case and consideration must be given to the performance and behaviour of concrete structures under fire conditions. In addition, where tunnels and underground spaces are concerned, consideration must also be given to the provision of services protection, e.g. smoke extraction systems, protection to cables and wiring servicing emergency equipment etc.

There are three reasons for providing protection against fire within tunnels, firstly, there is the matter of life safety, this is not necessarily a function of structural performance under fire, although a collapsing structure would not enable people to exit a structure in safety, but more to do with the function of services such as emergency lighting, smoke extraction systems etc.

Secondly there is the performance of the structure itself, will it remain in-situ, will it collapse, possible causing collateral damage to other structures and injuries to people passing by etc.

Thirdly, there is the economic damage caused as a result of the failure of a tunnel etc. This economic cost is not related solely to the repair or rebuilding of the structure; more usually it is the knock on impact of loss of business, traffic diversions etc which result in the largest costs. A prime example of this is the fire inside the Channel tunnel where the economic damage was estimated to be over twice the cost of the actual tunnel repairs, the direct repairs to the tunnel cost some €87 million, the additional costs in lost business, replacement of infrastructure, materials e.g. lorries, train carriages etc bring the economic loss alone to some €211 million. Using Mont Blanc tunnel as an example for a simple road tunnel, the differences are not so marked, with the cost of repair being estimated at some €189 million and the economic cost at some €203 million in addition. However, some two years after the fire occurred, Mont Blanc tunnel is still closed to commercial traffic, and the economic costs of diverting heavy goods vehicles continues to mount up.

Thus in terms of fire protection within tunnel and underground systems, the following items require consideration.

- Enhancing the fire resistance of the structure
- Air supply systems
- Smoke extract duct systems
- The provision of fire and smoke resistant safe havens in long tunnels
- Active and Passive detection systems
- Fire extinguishing systems

TYPES OF FIRE CURVES IN TUNNELS

In recent years, a great deal of research has taken place internationally to ascertain the types of fire, which could occur in tunnels and underground spaces. This

Aftermath of Fire in Mont Blanc tunnel, France

research has taken place in both real, disused tunnels, and under laboratory conditions, as a consequence of the data obtained from these tests, a series of time/temperature curves for the various exposures have been developed as detailed below.

The RWS curve was developed based on the assumption that in a worst-case scenario, a fuel oil or petrol tanker fire with a fire load of 300MW lasting up to 120 minutes could occur.

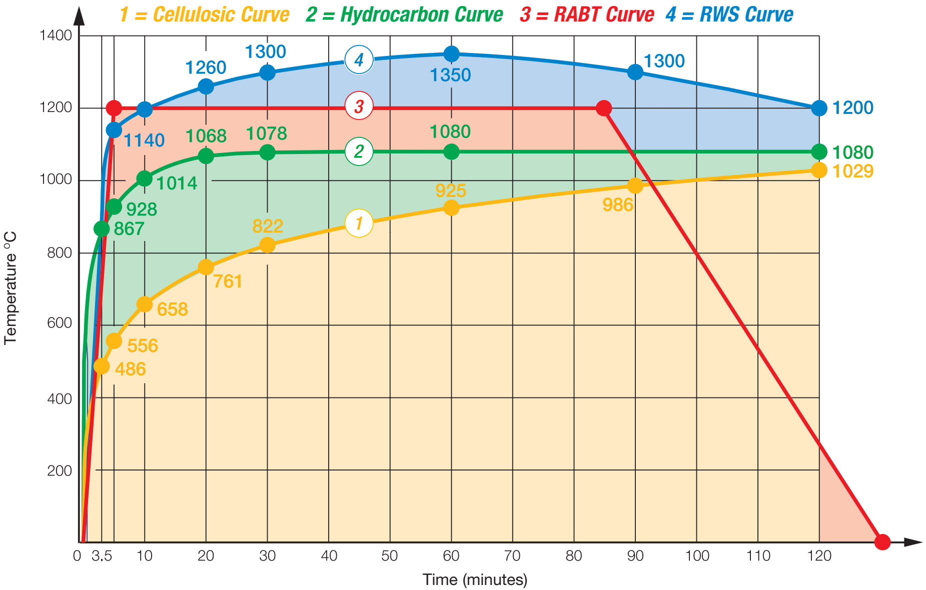
The RWS curve was based on the results of testing carried out by TNO in the Netherlands in 1979. The difference between the RWS and the Hydrocarbon curve, bearing in mind that they are both using as the fire load similar materials, is that the latter is based on the temperatures that would be expected from a fire occurring within a relatively open space, where some dissipation of the heat would occur, whereas the RWS curve is based on the sort of temperature you would find when a fire occurs in an enclosed area, such as a tunnel, where there is little or no chance of heat dissipating into the surrounding atmosphere.

The RWS curve simulates the initial rapid growth of a fire using a petroleum tanker as the source, and the gradual drop in temperatures to be expected as the fuel load is burnt off.

The RABT curve was developed in Germany as a result of a series of test programmes such as the Eureka project. In the RABT curve, the temperature rise is very rapid up to 1200°C within 5 minutes, faster than the Hydrocarbon curve, which rises only to 1150°C after 60 minutes. The duration of the 1200°C exposure is shorter than other curves with the temperature drop off starting to occur at 60 minutes.

This test curve can be adapted to meet specific requirements, in testing to this exposure, the heat rise is very rapid, but is only held for a period of 30 minutes, similar to the sort of temperature rise you would expect from a simple truck fire, but with a cooling down period of 110 minutes. If required, for specific types of exposure, the heating period can be extended to 60 minutes or more, but the 110 minute cooling period would still be applied.

Over the past hundred years or so, as stated in the introduction, millions upon millions of people have come to regard concrete as a solid and dependable product, used in every conceivable type of structure; for buildings, bridges, tunnels and sometimes even ships.



Time/temperature curves

Concrete has always been thought of as behaving well in a fire. Not just because it is non-combustible, but also because as part of a structure, concrete has better fire-resistant properties than, say, unprotected steel. Yet if we compare the loss of strength in concrete and steel as temperature rises we find that the two materials differ very little in this respect.

The fire resistance of a concrete structural member is derived from the following properties:

Low coefficient of thermal conductivity
This term refers to the fact that the heat generated by exposure to fire is less able to penetrate structural members.

High thermal capacity
This means that the rise in temperature in the outermost surface layer of the concrete is far more rapid than in that within the depth of the concrete. As a result, the average rate of temperature rise in a concrete member is relatively low.

MASS

Because concrete has less inherent strength than steel, the cross sections of concrete structural members are always larger, given the same loadbearing capacity, than those of steel members. Only reinforced or pre-stressed concrete can absorb tensile stresses. However, the behaviour of the reinforcement is important not only in structural members subjected to bending and tension but also in reinforced concrete members subjected to compression.

In a fire, the rate of temperature rise to the critical temperature (approx. 500°C) in reinforcement subjected to tension is comparable to that in a steel girder, assuming that the steels are of approximately the same type and the maximum tension is of roughly the same order of magnitude. Experiments using standard fires (see figure on the following page) have shown that where reinforcement lacks the protection afforded by the concrete this critical temperature of approx. 500°C is reached within 10 minutes of exposure to the sort of temperatures that would be expected under fire conditions.

Given that a concrete member has inherently good fire resistance, the question naturally arises why, then, it is necessary in certain circumstances to protect it with fire-resistant cladding. Laboratory tests have shown that concrete structures subjected to compression generally fail when their compression strength is exceeded. In practice it will be rare for an entire structure to be subjected to compression, except perhaps where pre-stressed concrete has been used.

In the laboratory the concrete cross-section is heated by a standard fire. As a result of this the strength of the concrete falls until the critical temperature is reached. The critical temperature depends on the load. Netherlands standard NEN

6071 sets out, in 10.1.2.1, a simplified method of calculating this. There it is assumed that a cross-section is fully loadbearing at a temperature of 500°C or less. However, this 500°C is not the critical temperature: the hotter shell continues to bear some of the load while the core is not 100% loadbearing.

- Free & Chemically bound water combine to cause steam pressure build-up
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- Temperature in excess of 500°C
- Concrete Grade dependant
- Moisture content over 3% = spalling almost 100% within 30 minutes of exposure.

NOTE: On recent tests carried out on tunnels in Netherlands, the average moisture content of the concrete 10 years after construction was approximately 6–7%.

SPALLING

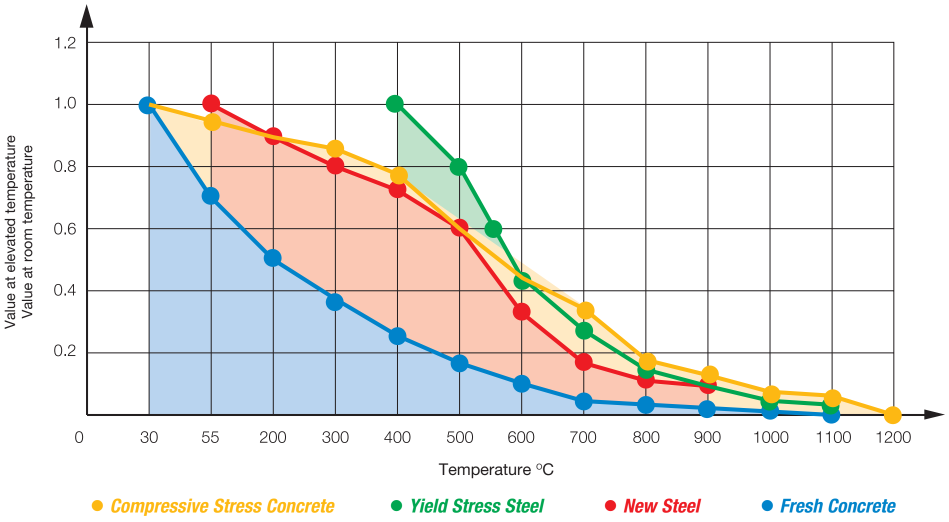
What is spalling? When mature dried concrete is exposed to extreme heat for long periods of time, the chemical bonds between the water molecules in the concrete break, destroying molecular bridges that bind together the various materials that make up concrete. As the water molecules are pulled out of the skeleton through dehydration, the concrete loses its cohesion and weakens, pushing pieces of the concrete off the tunnel walls in very thin layers resembling onion peel. This phenomenon, called spalling, can eventually work its way through the entire concrete ring lining a tunnel, layer by layer.

Research has shown that concrete structures can suffer surface spalling as a result of high compression stresses in the heated outermost layers and by the generation of water vapour at a high pressure behind those layers. The probability of spalling increases with compression stress and the moisture content of the concrete. With a moisture content of over 3% of the mass, the probability of spalling is virtually 100%. It is precisely in columns and prestressed beams that compression stresses are high.

Rapid rates of heating, large compressive stresses or high moisture contents (over 5% by volume or 2% to 3% by mass of dense concrete) can lead to spalling of concrete cover at elevated temperatures, particularly for thicknesses exceeding 40 mm to 50 mm. This moisture is not only physically present, but also chemically bound within the concrete.

The latest investigations into the fire performance of concrete show that even the addition of polypropylene fibres into the concrete mix, will not suffice to reduce this water vapour pressure, and thus has little effect on reducing the incidence of spalling.

Such spalling may impair performance



Influence of temperature on concrete

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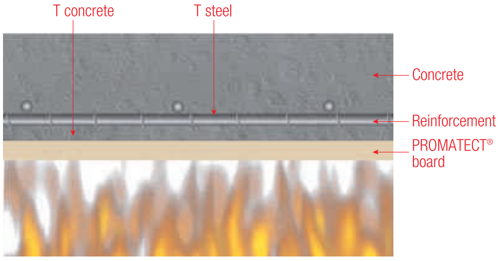
> *Concretes made from limestone aggregates are less susceptible to spalling than concretes made from aggregates containing a higher proportion of silica, e.g. flint, quartzites and granites.*

by exposing the reinforcement or tendons to the fire or by reducing the cross-sectional area of concrete. Concretes made from limestone aggregates are less susceptible to spalling than concretes made from aggregates containing a higher proportion of silica, e.g. flint, quartzites and granites. Concrete made from manufactured lightweight aggregates suffer a lesser degree of spalling. The use of high strength concrete has been introduced as it can reduce the necessary thickness required to obtain a certain structural performance, however, high strength concrete is particularly prone to severe spalling when exposed to fire, as such, because the depth of the concrete has been reduced already, the effects of spalling are even more severe than normal.



Reinforcement temperatures

In addition to surface spalling, the in depth research that has taken place, both after real fires, and when tests have been carried out in disused tunnels (e.g. the Eureka project) show that deep cracks will appear in the concrete after the substrate has cooled down.

When spalling occurs which can also be dangerous for the immediate environment due to the explosive nature of the spalling on some types of concrete the reinforcement is exposed. In a normal fire ordinary reinforced concrete is unlikely to fail completely but repair costs can be considerable. Where prestressed concrete has been used the detrimental effect of spalling is greater and more dangerous.

Based on the requirements for exposure to an RWS type fire:

Temperature on the concrete interface should not exceed 380°C (for bored tunnels this limit is 200–250°C)

Temperature on the reinforcement should not exceed 250°C with a minimum of 25mm concrete cover

NOTE: For exposure to RABT, the reinforcement temperature should not exceed 300°C.

There is a high risk of failure due to the temperature of the steel in the concrete in columns with a high reinforcement level under high loads. For this reason, the (non-normative) tables give a critical steel temperature of 500°C for ordinary concrete, steel and 400°C for tension steel. In the Netherlands, Rijkswaterstaat lays down for tunnels a maximum permissible concrete surface temperature of 380°C. This maximum was set not because of any perception that concrete fails at that temperature, but because it is assumed that in practice this is a temperature at which there is only a very small probability of damage to concrete. This requirement also implies that the temperature of the underlying reinforcement remains low, so that its strength is unimpaired. In Switzerland the maximum is set even lower: there the surface of the concrete in tunnels must not exceed 250°C.

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DRAEGER SAFETY FIRE FIGHTING HELMETS

The modern firefighter often works in environments requiring the best protective gear and clothing. Besides fire suits, gloves and boots, helmets and other head protection equipment play important roles in protecting the firemen from unpredictable surroundings.

ST 5692

Draeger Safety and Schuberth Helme has joined hands to develop a series of head protection gear to meet the high demands of firefighters and rescue workers. Both companies are traditional leaders in their own fields: Draeger in safety technology and Schuberth in head protection systems.

The launch of the HPS 6100 firefighting helmet and the HPS 4100 halfshell helmet represents the first products to come from Draeger's Head Protection System (HPS) range. Launched after extensive collaboration and research, both products showcase the innovation, reliability and comfort that will be seen in future products to come.

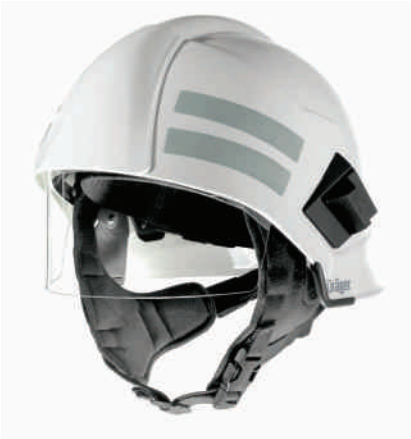
The Draeger HPS 6100 is an innovative fire fighter helmet which combines the highest safety standards with extraordinary wearer comfort. Thanks to its shell made from highly heat-resistant Duroplast, the helmet offers complete protection even in extreme heat. At the same time, its modern lining of flame-resistant, washable Nomex fulfils all your needs for a secure fit and real comfort.

When used with a breathing apparatus, the patented Dräger-Supra adaptor and fast adjustment mechanism allows the wearer to put on a Dräger mask quickly, safely and comfortably. The helmet's 3-point Aramid chinstrap, Nomex hairnet and headband made of washable "ecological leather" further contribute to the wearer's safety and comfort. A wide range of accessories is available and customisation of the helmet with identification markings is easy, This allows you to individualise the helmet according to your needs.

The new Dräger HPS 4100 is the updated version of the traditional half-shell helmet and offers the latest in safety, wearer comfort and cost-effectiveness. It's newly designed, high heat-resistant Duroplast shell offers reliable protection even in the most extreme heat. A modern lining of flame-resistant, washable Nomex and the 4-point Aramid chinstrap ensure the Dräger HPS 4100 helmet fits securely and comfortably. The easily adjustable neckstrap and ergonomic sniper buckle made of highly heat-resistant plastic further contribute to making the Dräger HPS 4100 a reliable partner in action.

With these two new helmets, Draeger and Schuberth sets the standard higher in innovative, reliable and integrated head protection systems worldwide.

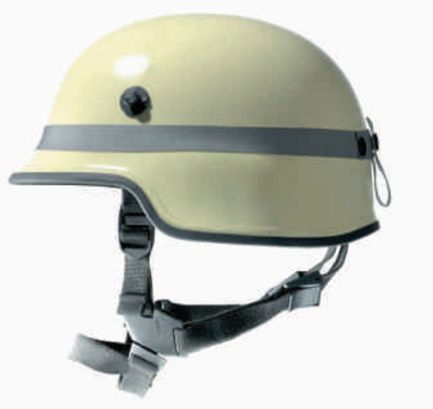
HPS 6100 Helmet



Features at a glance:

- Outer shell made from high heat-resistant polyester reinforced fibreglass
- Lined with flame-resistant, washable Nomex
- Adaptor connections for combination with Dräger breathing masks
- Fast adjustment for wearing a mask with a 5 point head strap
- 3-point chin/neckstrap
- Aramid straps with a quick release buckle
- Weight: approx. 1,250 g
- Optional gold visor or mesh visor
- Certification: EN 443: 1997

HPS 4100 Helmet



Features at a glance:

- Outer shell made from high heat-resistant polyester reinforced fibreglass
- Lined with flame-resistant, washable Nomex
- Aramid straps with ergonomically shaped sniper buckle
- 4-point chin/neckstrap
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- Certification: EN 443: 1997

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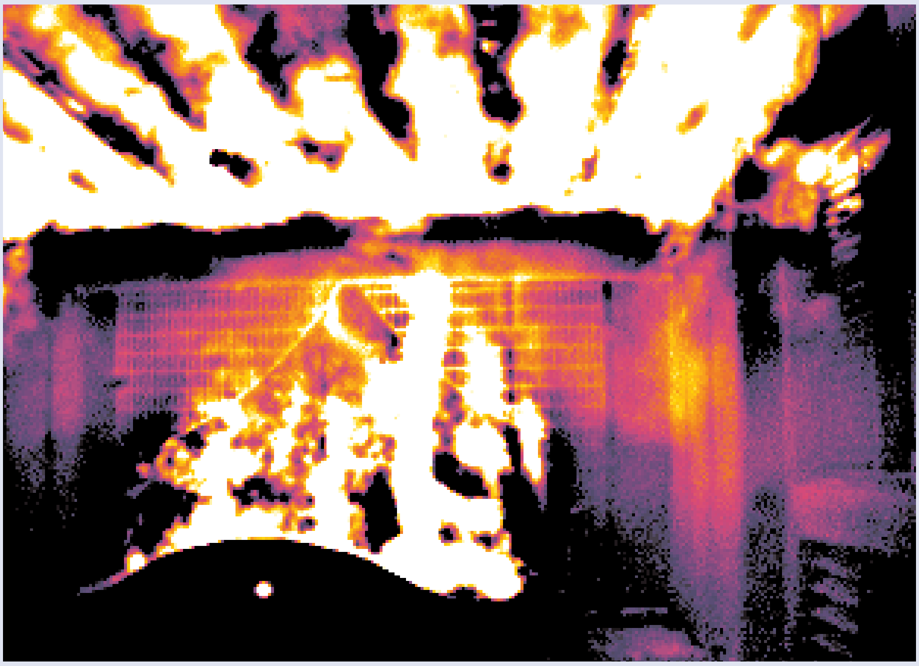
Thermal imaging extends its

By Nicky Probyn



Picture courtesy of e2v Technologies

Thermal imaging cameras have been used in fire fighting environments for nearly twenty years; the technology is well known and extensively used within the industry. The history is well documented – but what about the present and the future? What are thermal imaging cameras capable of and what developments lay ahead?

Budgets in most countries for fire and rescue equipment are limited, so deciding where funds should be allocated is a key decision for all involved. Do you know what thermal imaging can do for you? Is a thermal imaging camera seen as a luxury item or are there serious, life saving benefits, efficiency and safety issues to taking a camera into a fire?

Technology has come a long way since the move from the vacuum tube based Pevicon™ devices to solid-state sensor based cameras. Picture quality has vastly improved, reliability has increased five fold – which has in turn reduced the cost of ownership and most manufacturers now offer an upgrade path to their latest model. A positive side effect is that manufacturers today offer a variety of warranty packages, which can include a 2-year standard warranty for peace of mind. Thermal imaging sensor technology is well established and, customers being more demanding than ever, technology today offers the end-user a host of features designed to make their life in a fire safer and easier – as well as effectively assisting them in doing their job!

Ergonomics on thermal cameras have been enhanced greatly compared to older style cameras, which were often bulky, difficult to operate and required many user inputs to maintain a good picture. They were also prone to faults because of the technology used. Newer style cameras are smaller, lighter and often have simple button operations, with instant on and delayed off switches to prevent inadvertent switching off when in use. Newer designs also offer wider LCD screens allowing a team to view the same image in order to share information effectively and quickly.

Picture courtesy of e2v Technologies

Batteries and battery life have also taken a step forward. Fire fighters can now expect a standard of at least 3 hours continuous battery life from re-chargeable batteries. Standard AA Ni-MH batteries can also be used to power the cameras. Battery doors are constructed to allow gloved hand opening and the ability to change in zero visibility. This further reduces the cost of ownership for brigades and makes it easier to make sure your thermal camera is always fully operational.

Cameras offer two types of temperature detection to aid fire fighters in determining the heat of their surroundings – ambient temperature measurement gives fire fighters rapid identification of areas of heat, thus allowing effective direction of water spray or extinguishant at the hottest area. Detected differences in heat can indicate dangerous situations and the fire fighter can make a decision whether to evacuate the premises or continue the search. Enhancing this option, Spot Temperature Measurement enables fire fighters to pinpoint the exact heat of objects or obstacles, again saving time and extinguishant by allowing fire fighters to focus on the hottest part. This option enables fast and effective location of the seat of a fire or detecting hot spots in cavity walls or behind doors – indicating potential danger in another room. In addition, this feature can be useful for determining the temperature within enclosed capsules or spaces, even measuring the temperature of gas cylinders.

Improved picture quality today not only allows fire fighters to view images in far more detail than was possible with older cameras but latest offerings allow full colour options. Various screen colour settings enable fire fighters to switch between monochrome all to the way to full colour. This makes detecting changes in heat and finding the hottest part of an image on the screen easier, faster and more reliable thus saving vital seconds in scene assessment.

Coupled with improved image quality comes another unique innovation – picture capture. This feature, currently offered only on e2v technologies'

reach into multiple applications

Argus®3,[1] allows fire fighters – using the thermal imaging camera – to take up to 26 pictures at the scene of a fire. This is a significant aid in forensic investigation as it captures evidence in the fire ground before it is destroyed by the blaze and can help deliver vital clues as to the source of fires and provide data for analysis and investigation. Pictures taken can be downloaded from the camera to a PC or Laptop using a supplied connection lead and subsequently inserted into an incident report. This feature also assists in training fire fighters.

Remote wireless video (telemetry) on thermal cameras allows remote viewing of the fire scene. Station commanders can monitor what is happening from the outside of the fire and, if necessary, send in backup to help deal with an incident. This option is also useful for training purposes. In addition, telemetry allows fire fighters to record footage of what is happening in the blaze/training exercise for later analysis and effective de-briefing of personnel.

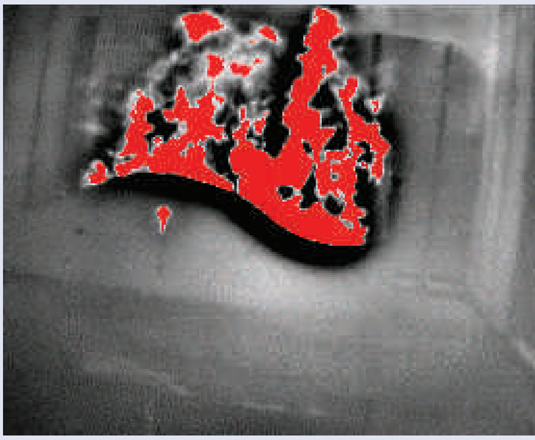
Finally, remote control set-up and user personalisation allows fire fighters the flexibility to enter their personal settings in terms of screen colour, white or black hot, contrast, brightness etc on the camera before entering into the fire ground. A station or brigade logo can also be uploaded onto a splash screen on cameras to improve asset tracking. All settings are defined before the fire fighter enters the blaze.

Not only have the features on the cameras increased, but the applications they are used for have in turn widened.

Thermal cameras today are so versatile that using them simply for fire and casualty detection seems a waste. There are a many different applications aiding not only civilian fire personnel but also marine and airport fire brigades, not only in search and rescue but in fire detection as well.

Take the marine market for instance. There have recently been a host of marine accidents starting in various places around vessels but often in engine rooms or electrical systems. Overheated motors can develop into blazing infernos. Using a thermal imaging camera as an engineering tool allows gearboxes, motors and bearings to be regularly monitored facilitating the rapid identification and elimination of hotspots. Pipe work and distribution panels can be similarly investigated for faults. Condition monitoring and faultfinding using thermal cameras in this way increases safety standards on ships and helps prevent fires altogether.

Once a thermal imaging camera is on board a vessel, if a fire does start, using the camera for casualty location is also of paramount importance as passengers can become disoriented by smoke logged



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Picture courtesy of e2v Technologies

corridors and become unable to find their way to an area of safety. Thus, what was once considered an unnecessary investment has been transformed into a multi-functional tool that can become essential to the safe operation of the vessel.

Similarly, thermal imaging cameras are widely used in airports for aviation fire fighting – mounted on the outside of a fire appliance, the camera allows a driver to take his vehicle through thick smoke which means that the team can lay down foam faster and more accurately. With aircraft incidents involving hot brakes, aircraft wheel brake assemblies can be rapidly inspected to give an accurate indication of their temperature. In airport terminals, surveys of escalator motors, distribution panels and air conditioning ducting can be rapidly undertaken, as part of fire prevention schemes.

Finally, thermal imaging cameras have become widely used for tunnel fire fighting. In France and Italy, new fire trucks utilising two driver cabins to eliminate having to turn trucks in tight tunnel environments have used thermal imaging cameras mounted at either end of the truck to help them navigate through the thickest smoke in a emergency situation. This application was introduced after the Mont Blanc Tunnel tragedy in 1999 where people were trapped in a tunnel fire that lasted 50 hours with fire crews unable to enter because of the intense heat and smoke. Sadly, 38 people were eventually reported dead. Thermal imaging cameras were trailed after this incident to assess their possible contribution to tunnel fire fighting and they are now important fixtures on fire trucks servicing tunnels.

It has become obvious that the applications for thermal imaging cameras are extending and that the functionality offered on latest generation cameras facilitates this. Features and options offered on today's cameras, in addition to increased reliability and technological advances, make thermal imaging not only a wise choice but also a sound investment. However, the technology can only go so far – what lies ahead? Currently, talk about integrated fire fighting system – thermal imaging using breathing apparatus as the backbone of a system – is becoming more and more common. However, the technology within cameras is constantly developing and in the future systems that integrate all components of fire fighting: vision, air, communications, hazardous gas warnings could be seen. Currently, due to increased competition in the market and technological advances in cameras, users are substantially better catered for than they ever were in the past.

> The most important aspects in making the right choice of camera, surrounds not only the initial cost of ownership, ergonomics and functionality specific to applications but the on-costs associated with day to day maintenance, consumables (such as batteries), reliability (in terms of the technology used) along with the warranty offered.

Heat Stress:

Ignore The Signs At Your Peril

Picture courtesy of Bristol Uniforms, Ltd

The warning signs of heat stress are still not recognized or are being ignored by many firefighters. Jeffery W Petersen provides a checklist of physical symptoms and gives new data showing that the mental effects can be equally dangerous.

Heat stress refers to the combination of environmental conditions, metabolic rate from activities we do and clothing that we wear, which will increase our core temperature. Our body tries to achieve a balance between heat gain and heat loss, but it is when this balance is compromised that the body is unable to function at its optimal level, writes *Jeffery W Petersen.*

The major source of heat gain is the internal heat generated through activity the body undertakes. Of the energy expended during this activity, only about 25 per cent is translated to mechanical work, the remainder being released as heat in the contracting muscle. The harder the human body has to work during a particular activity, the more internal heat is generated.

The major avenue for heat loss is evaporative cooling through evaporation of sweat from the skin's surface. When heat balance is compromised, the body will try to direct the heat away from the core by increasing blood flow to the skin. At the skin surface, water secreted from sweat glands absorbs heat from the skin, changes from a liquid to a vapor and is carried off by the surrounding air. Because the heat of vaporization is quite high, small amounts of sweat remove relatively large amounts of heat.

Picture courtesy of Jeff Petersen

It is well known in the Fire Service the world over, therefore, that to maintain normal body function; fluid must be replaced as soon as possible.

It is also well known that by the time somebody experiences thirst, they are probably already dehydrated and potential functional capacity will already be significantly reduced.

The rate at which people sweat is determined by three main factors – state of acclimation (acclimatization); aerobic fitness; and genetics.

Acclimation is a physiological adaptation that the human body makes with repeated exposures to heat stress during exercise; it increases our rate of sweat production, shortens the time it takes for sweating response to start and conserves sodium.

Some of the best-acclimated firefighters are breathing apparatus training officers because of the repeated exposures during hot fire training. Regular and sustained aerobic exercise can elicit a similar response.

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Heat cramps

Symptoms: Painful muscle cramps, especially in abdominal or fatigued muscles
Signs: Incapacitating pain in voluntary muscles
First Aid: Rest in cold environment; Drink salted water (0.5 per cent salt solution); Massage muscles

Heat syncope

Symptoms: Blurred vision (gray-out); fainting (brief)
Signs: Brief fainting or near fainting behavior; normal behavior
First Aid: Lie on back in cool environment; drink water

Dehydration

Symptoms: No early symptoms; fatigue/weakness; dry mouth
Signs: Loss of work capacity; increased response time
First Aid: Fluid and salt replacement

Heat exhaustion

Symptoms: No early symptoms; fatigue/weakness
Signs: High pulse rate; profuse sweating; low blood pressure; insecure gait; pale face; body temperature normal to slightly increased
First Aid: Lay down flat on back in cool environment; drink water; loosen/remove clothing

Heat stroke

Symptoms: Chills; restless; irritable
Signs: Red face; euphoria; shivering; disorientation; erratic behavior; collapse; Unconsciousness; convulsions; body temperature more than or equal to 40°C
First Aid: Immediate; aggressive; effective cooling; transport to hospital

lower core temperature for the same level of heat stress. Fit firefighters also tend to have reduced levels of body fat, which means that they do not have to carry around extra (non-functional) weight, therefore requiring less energy to do the same job. Body fat is a very good insulator, which means that increased levels of body fat will compromise the body's ability to lose heat.

It does not matter how hydrated, how acclimated or how fit a person is – if the sweat cannot evaporate, then thermoregulation will be compromised.

It is therefore essential that firefighters are aware of the signs and symptoms of heat stress so that it can be identified early and the appropriate measures taken.

At the first sign of any of these symptoms the Officer in Charge should be notified and appropriate action taken, including work/rest cycles instituted; keep cool and avoid radiant heat; drink small amounts of appropriate fluids; avoid coffee, tea and alcoholic beverages; use cooling devices such as water spray bottles, damp towels and fans. Ice packs are not recommended.

Although technology and training have played a significant role in reducing the number of deaths and injuries from heat strain, it is a danger that firefighters continue to face.

The physical effects of heat strain have been well documented. However, recent research shows that there is a further deleterious effect on the mental state of people suffering from heat strain, which is equally dangerous.

Heat strain has a direct effect on a firefighter's mental agility and his or her ability to make decisions. The mental symptoms are not as readily identifiable in the heat of a large fire, but the consequences can be fatal. Research in this area has been led by the interest in reducing air force pilot error. Researchers found that the decision-making process is significantly hampered by the increased heat strain, with known consequences being decrement in mental performance, vigilance and eye/hand co-ordination.

Highly motivated heat stressed subjects exhibit a higher error rate, a narrowed attention span with neglect of secondary tasks and a diminished response to unusual events. The potential for injury to the individual and to those under his or her command is therefore much higher.

Stress limits for workers exposed to adverse thermal conditions have recently been challenged. Rather than basing exposure limits on a physiological criterion – i.e. increase in body temperature – it is suggested that changes in behavioral performance efficiency are a more sensitive reflection of human response to heat.

Reducing the risk of heat strain will also reduce the incidence of cardiac strain. In the USA, approximately 50 firefighters die each year as a result of cardiac arrest. Improved technology to reduce the risk of heat strain could have a positive impact upon these mortality rates.

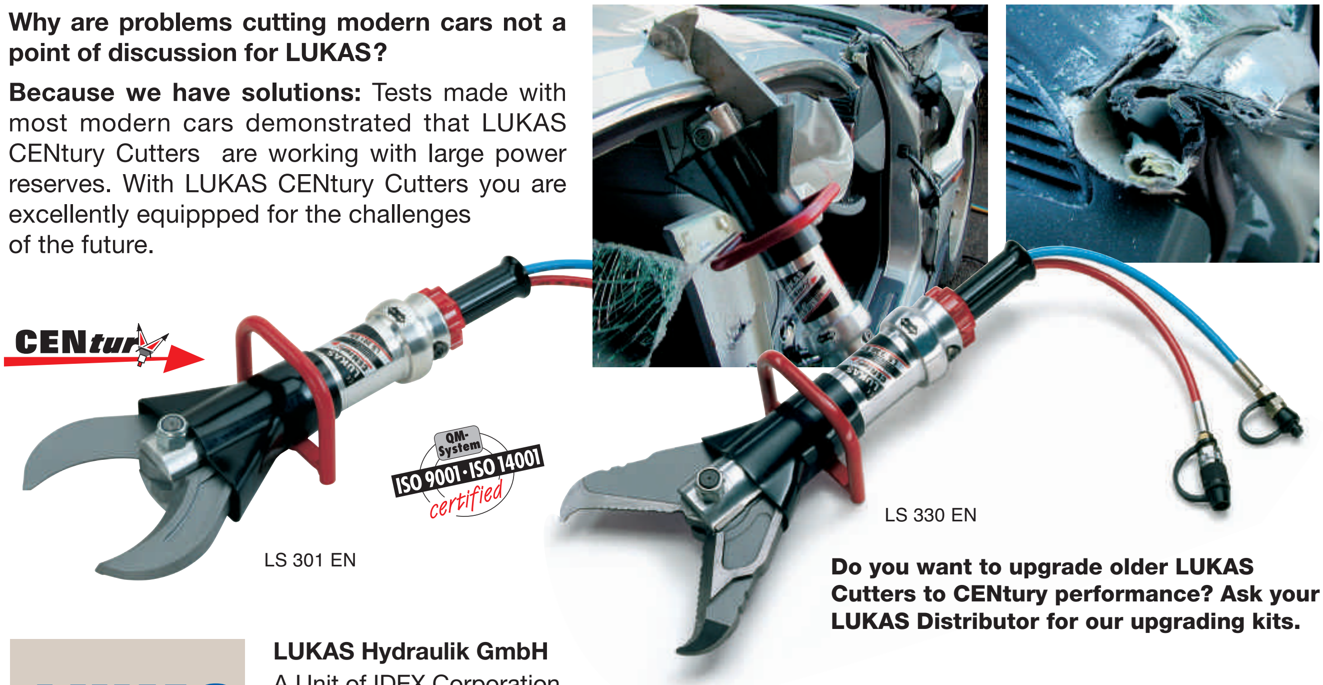
From general research and specific research undertaken at W.L. Gore and Associates (manufacturer of Gore-Tex waterproof and breathable fabric), we know that the inclusion of a breathable moisture barrier in a firefighter's ensemble can make a significant impact on reducing risk from heat stress to a firefighter carrying out moderate to light duties – i.e. 80 per cent of the normal workload.

Current technology is such that in the real extremes of temperature experienced when fighting a fire in an enclosed space, it is almost impossible to remove the build-up of heat from the body inside the protective clothing and, at the same time, protect thoroughly from the outside.

For most of the work undertaken by firefighters, a moisture barrier will have a distinct effect, allowing them to work for longer without to rest, lowering the increase in body temperature and reducing the risk of errors through poorer mental performance. Our research is currently aimed at creating new clothing technology that will offer these benefits in the most extreme temperatures.

Picture courtesy of Jeff Petersen

Jeff Petersen is an Australian freelance writer and a former 8-year veteran firefighter now living in Billings, Montana, USA.



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NEW LIGHTWEIGHT ERGOTECH™ RANGE OF FIREFIGHTERS CLOTHING PROVIDES GREATER ALL-ROUND COMFORT

Bristol Uniforms Ltd, the UK's leading designer and manufacturer of class leading firefighters clothing, has launched a new range of ergonomically designed lighter weight firefighters clothing.

Collaborating with its major UK customers, and listening to feedback from overseas distributors, the Company has spent a year working with key materials suppliers to develop a new concept in firefighting clothing featuring improved fit, greater comfort and less weight without compromising levels of operational protection. The result is the new Ergotech™ range.

Driven in part by the current international focus on the problems of heat stress, the Ergotech™ range helps reduce internal heat build-up from the wearer's body through the extensive use of breathable materials thereby offering extended operational performance and greater user safety.

Incorporating Nomex® and Goretex® fabrics, the new coat incorporates a tapered girth with a sleeve featuring a pre-bent construction and underarm gusset. Added protection and comfort are provided by closed cell foam padding to shoulders and elbows with an extended lined and laminated catch flap. The trousers also feature a pre-bent seat and knee construction for greater flexibility, a lower rise at the waist (fully compliant with EN469) and incorporate Arashield knee pads.

Ian Mitchell, Bristol Uniforms' Joint Managing Director, highlighted the benefits of close customer consultation in the new product development process commenting, "We strive to make our firefighters' clothing as comfortable as possible for the wearer consistent with the need to meet all requisite performance and safety standards". He added, "Close customer collaboration has been at the heart of our continued success and has enabled us to evolve garment design in a way which ensures our brand-leading styles remain widely respected both in the UK and our 90 overseas markets".

For more information, please contact:
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THE TALISMAN WASP

The **W**ireless **A**dvanced **S**ignal **P**rocessor (WASP) is the latest version of the world's best selling fire camera. Incorporating a number new features and utilising the latest generation of BST technology, the WASP continues to build the impressive reputation of the Talisman K90 series cameras.

New features added include:

- Built-in antenna and video transmitter
- Enhanced Dynamic Range control (even clearer images in high heat conditions)
- New internal construction providing enhanced shock protection.
- Times Two Zoom

The incorporation of sophisticated viewing optics within the camera body enables you to hold the camera directly up to your facemask and still see the image clearly... ideal for exceptionally dense smoke situations.

With all of the options you have come to expect (Video Overlay and Direct Temperature Measurement) the new WASP remains at the forefront of fire fighting camera design.

Selected by municipal firefighters the world over, and by over 30 of the worlds navies (including the US Navy) . . . the Talisman K90 series remains the most capable of all BST fire cameras.

Founded in 1992 by Charles Humpoletz and Alistair Watson, ISG Thermal Systems has grown into probably the most successful supplier of fire fighting cameras in the world.

Today, ISG supplies its advanced thermal imaging cameras both for fire fighting and security/surveillance applications worldwide.

With plants in England and the United States, ISG can provide worldwide support for its products.

ISG is an ISO 9001 accredited company.

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USE OF BATTERY-POWERED RESCUE TOOLS IN WET WEATHER CONDITIONS

Recently a new generation of battery-powered hydraulic cutters and combitools appeared on the market providing a greater degree of mobility and flexibility than any other powered rescue tool so far. Being tool and power source in one, compact, lightweight and cordless these battery-powered rescue tools are especially designed for use in difficult to reach areas or confined spaces – e.g. in collapsed buildings or deep down a ravine – where a maximum freedom of movement is required. As the latest models weigh less than 15 kg (including battery) they are also suitable to be carried over long distances. Apart from these features, battery-powered cutters and combitools offer the same cutting, spreading, squeezing and pulling performances as tools powered by traditional pumps.

Following the introduction of their battery-powered rescue tools, leading Dutch-based manufacturer of rescue equipment Holmatro saw two questions from the market coming to it quite frequently: what is the effect of using batteries as a power source on the tool's operation time and how does a battery-powered tool behave when used in the rain? These questions are answered below.

It is obvious that the operation time of battery-powered tools is not unlimited and depends on the battery's capacity. This problem has been anticipated, however, by equipping the new generation of battery-powered rescue tools with a so-called click-on/click-off system: if the battery is running low it can be replaced in a matter of only seconds. Along with the fact that modern batteries are rechargeable up to 100% capacity in less than one hour (e.g. in a vehicle's battery charger), quick and easy battery replacement ensures a long and continuous tool operation. Alternatively, the tool can be connected to any 12/24-Volt (e.g. car or truck) battery by means of a power cable to achieve unlimited run time.

During life saving operations rescuers must be able to rely on a problem-free operation of their tools under all circumstances and in any kind of weather. That is why Holmatro submits its battery-powered cutters and combitools – as well as any other tool in its rescue programme – to a great number of extensive tests, one of them being a rain test. During this test the tools are repeatedly exposed to heavy (simulated) rainfall over a period of time and under various angles, both while lying down and in operation. In each of the positions the tools still function perfectly, both after and during this period of heavy rainfall.

The conclusion of the rain test as performed by Holmatro is that at least these battery-powered rescue tools can be marked as 'heavy rainproof' which makes them suitable for use in wet weather conditions. Holmatro likes to stress the fact that the battery-powered tools are not fit for under water rescue operations. Nevertheless, there is no reason for rescuers to worry about heavy showers while on their way to remote accident locations!

For more information please contact:
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Website: www.holmatro.com

WHEN IT GETS TOUGH!

LANCIER Hydraulik GmbH & Co.KG, Münster, Germany with positive outlook for the future. After more than six months, the turbulences caused by the insolvency of Peter LANCIER GmbH & Co.KG, Münster, Germany are gone. The business nearly goes on without negative effects.

For this the board of LANCIER Hydraulik GmbH & Co. KG says thank you to all agents, distributors and of course to the end users. Although there were elements of uncertainty, nearly all of them keep trusting the LANCIER product line.

With a new website, LANCIER Hydraulik will be presented within the internet starting end of April. Under www.lancier-hydraulik.com. All interested parties can get full information about the company and of course about the wide range of products available.

The website will be updated on a regular bases, so that it will be the most current source for information about LANCIER Hydraulik products. A highlight will be set by special offers, those will only be published through the internet.

For more information, please contact:
LANCIER Hydraulik GmbH & Co. KG
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E-mail: info@lancier-hydraulik.com

SECOND GENERATION DECON SHOWER INTRODUCED BY PPS

Metal Frame Units Will Complement Inflatable Range

A second generation of decon showers based on a mechanical articulating frame technology is announced by Professional Protection Systems. The new range will complement the company's range of inflatable decon showers. Since their introduction in 1996 PPS has built up a world reputation for its inflatables and in 2001 won a major NHS contract to equip hospitals and ambulance services with the UK's first standard decontamination shower based on the inflatable principle.

The patented articulating frame technology, made from aircraft standard aluminium, at the heart of the new range was sourced by PPS in the USA. Units range from an individual decontamination shower suitable for Hazmat incidents to a mass decon unit that is large enough to provide two ambulatory lines and one non-ambulatory line.

Standard features of the new units include an integrated fabric shower requiring no installation, contaminant containment internal and external and a white canopy top to provide ambient, natural light. The canopy itself is UV stabilised, fire retardant and chemical resistant.

All of the new shelters include a transport bag, ground sheet, windows, utility ports repair and anchor kits as standard supported by a large range of accessories to suit all specifications.

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Founded in 1937, RectorSeal® has grown steadily over the years through a commitment to providing high quality products and services. With a diversified business strategy, the company is aggressively pursuing new and unique technologies to serve the plumbing, hardware, heating, air conditioning, and construction markets both domestically and internationally. RectorSeal® is devoted to providing innovative quality products supported by strong customer and technical service.

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Subscription Rates: Sterling £35.00 AUS Dollars – $100.00
US Dollars – $55.00
Back Issues: US $8.00 or £5.00 each inclusive of P&P
(subject to availability)

METHODS OF PAYMENT:

Website Subscription: www.apfmag.com

Cheque: MDM Publishing Ltd.

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Expiry Date:

MDM Publishing Ltd.
18a, St. James Street, South Petherton, Somerset, TA13 5BW, UK

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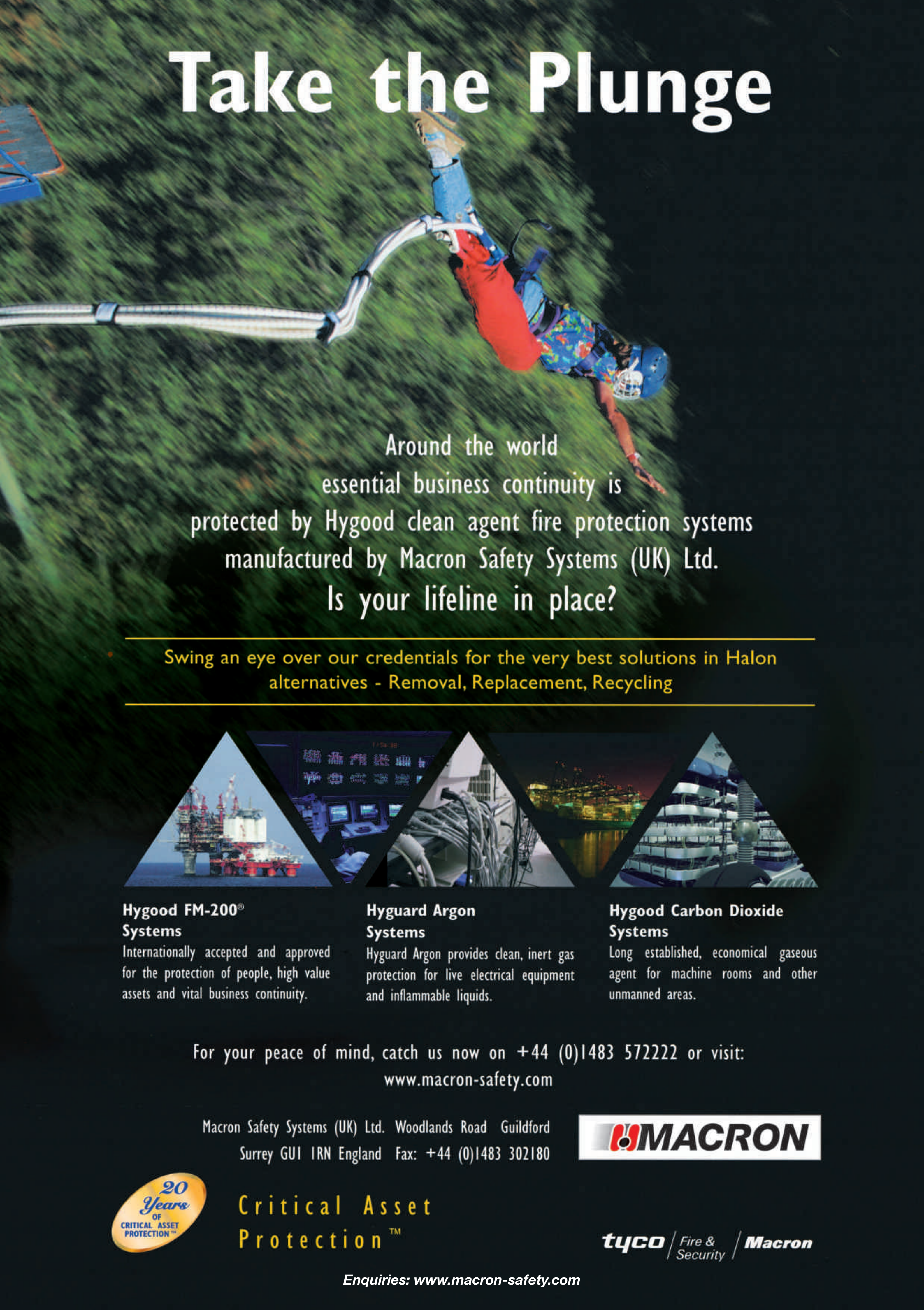

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An MDM PUBLICATION
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ASIA PACIFIC FIRE MAGAZINE
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REPORTING TO THE ASIA PACIFIC FIRE PROTECTION AND FIRE SERVICE INDUSTRY

Front cover picture: Copyright © Kim Kyoung-Hoon/Reuters

Publishers
Mark Seton & David Staddon

Editorial Contributors
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APF is published quarterly by:
MDM Publishing Ltd
18a, St James Street,
South Petherton, Somerset TA13 5BW
United Kingdom
Tel: +44 (0) 1460 249199
Fax: +44 (0) 1460 249292
e-mail: apfmag@globalnet.co.uk
website: www.apfmag.com

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Periodical Postage paid at Champlain New York and additional offices
POSTMASTER: Send address changes to IMS of New York, P O Box 1518
Champlain NY 12919-1518
USAUSPS No. (To be confirmed)

Subscription Rates
Sterling – £35.00 AUS Dollars – $100.00
US Dollars – $55.00
(Prices include Postage and Packing)
ISSN – 1476-1386

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Page design by Dorchester Typesetting Group Ltd
Printed by The Friary Press Ltd

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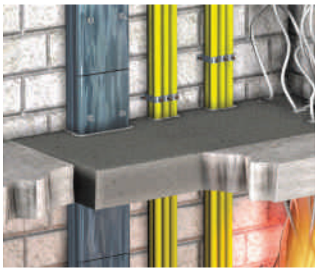

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FOREWORD

by Jeff Godfredson

NFPA's Asia-Pacific Operations Director

Security vs Fire Safety

I recently participated in a trade show in China. The particular event was a combined Security and Fire Protection Equipment Show which is becoming more common these days. During the event I had a discussion with one of the attendees. He was of the opinion that given the current state of the world, fire safety and egress from buildings will have to take second place to security. Not surprisingly I disagreed strongly with his assertions.

The comments reminded me of similar comments I had heard some 25 years ago as I was becoming more involved in the area of Fire Safety. At that time the priorities were more likely to be concerned with theft than terrorism. It was not true then and it is not true now.

The issues of security and fire safety are not mutually exclusive. It is possible to achieve a balance that deals with both issues. It must be said that it is not possible to guarantee 100% public safety and security at all times against all events.

It is however possible to achieve high levels of both with well integrated design, which takes advantage of latest knowledge and technology. It is interesting to note the convergence of the technologies used for both functions such as Closed Circuit Television (CCTV) being used as both intruder and flame detector. A further indicator of this convergence is the fact that NFPA is now in the process of developing codes for use by the security industry (see **www.nfpa.org**)

A close to home indicator of the problems of security vs. fire safety is the increased use of security grills to protect homes and intruders from gaining entry. Unfortunately these devices will also trap occupants and delay the response of emergency services. A simple emergency release device fitted to the interior of the building can do much to alleviate the problems.

A close examination of recent terrorist activity such as the events at the World Trade Center show that adequate means of egress played a significant role in reducing the number of casualties and that terrorists did not enter the building by conventional means. The events at the Marriott Hotel in Jakarta also show that terrorists do not need to enter a building to cause problems.

The issues of fire safety and security should not be dealt with in isolation but by an integrated approach dealing with all involved parties.

Jeff Godfredson
NFPA's Asia-Pacific Operations Director

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PPV: Enhancing Fire Fighter Safety

By Leroy Coffman,
President Tempest Technology, Inc.

Picture courtesy of Tempest Technology, Inc.

Positive Pressure Ventilation (PPV) is a versatile fire fighting tool that helps to enhance firefighter safety by creating a safer environment inside a burning structure. PPV was first developed in the United States in the 1960's and was used on a limited basis by progressive fire departments. In the early 1990's, information about the use and applications of PPV became widely available and research was conducted to study the benefits it offered to fire fighters. Today, PPV is an accepted fire fighting technique that is used by fire departments and fire brigades around the world.

PPV works on the principle that air flows from a high pressure point to a low pressure point. A properly designed PPV blower generates a cone-shaped air pattern and the blower is positioned so that the air pattern covers (seals) the entrance to a structure. Once this seal is achieved, the air pressure in the structure rises due to the air being forced into it. When an exhaust opening is created near the location of the fire, the smoke, heat and gases are forced out of the structure. In a matter of minutes, the hostile interior environment is replaced with clean, fresh air.

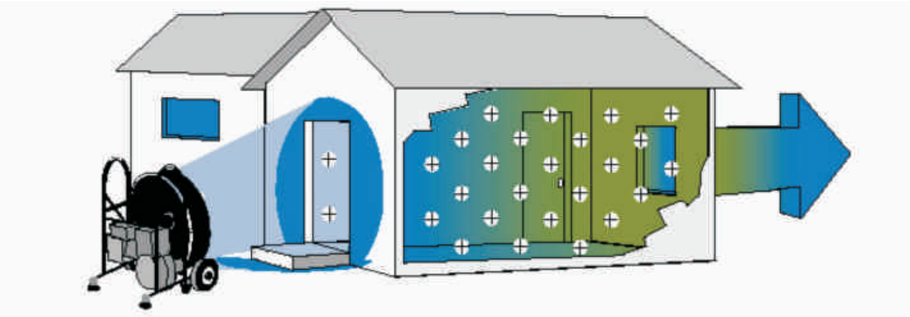
PPV benefits fire-fighting personnel by creating a safer environment inside an enclosed burning structure. The removal of smoke makes it easier for them to find victims and the location of the fire. The removal of heat allows them to move freely within the structure. Removal of hot gases reduces the possibility of flashover. Ultimately, PPV benefits victims by increasing their chances of survival.

NEW PPV BLOWER FEATURES

When PPV was first introduced, the PPV blower was very basic in design and functionality. It consisted of a 5hp engine, a frame, an air movement impeller, and an impeller housing (a shroud or cage). It was not ergonomically designed and was only effective on smaller structures due to its limited air movement capabilities. While the basic makeup of the modern PPV blower has changed little from the early designs, today's PPV blowers are more powerful and user-friendly:

■ **New Engine Technology:** The advances in gasoline engine technology have improved the power generated by small engines. Overhead valve engines are now standard technology on most blowers, which has greatly improved reliability and performance. Blowers have been developed with engines as large as 13hp, which provide twice the air movement of compartment-sized PPV blowers.

■ **User Friendly Features:** Ergonomics has played a role in current PPV blower design with most models now featuring wheels and retractable handles, making it easy for one fire fighter to quickly



Typical PPV Set-Up

PPV: Enhancing Fire Fighter Safety

Picture courtesy of Tempest Technology, Inc.

deploy the blower. New impeller designs have been developed specifically for PPV blowers, greatly improving their ability to generate a powerful cone of air to seal the entrance opening. Foot-operated and quickly release tilt mechanisms can be found on many PPV blowers as well.

■ **Electronic Motor Technology:** In the early days of PPV, gasoline engines were the desired power source because electric motors could not provide enough CFM to adequately ventilate a structure. Today, electric motors with advanced electronics and variable speed controls rival the airflow performance of gasoline powered PPV blowers. This can be a benefit when noise and carbon monoxide from engine exhaust are a concern.

■ **Big Air Movement:** The most radical new PPV product to be developed in recent years is the truck mounted PPV fan. Often referred to as an MVU or MGV, these large mobile ventilation units can be used to ventilate road tunnels, rail tunnels, large industrial structures and subway systems. They apply the same ventilation principles as the smaller PPV blowers, yet are 60″ in diameter, feature 120hp engines, and generate air flow over 255,000 m^3/hr (150,000 CFM).

NEW PPV APPLICATIONS

The versatility of PPV allows to be used on a variety of structures to help fire fighters manage any hostile interior environment. PPV can be applied to any size or shape structure, as long as the PPV blower is large enough to increase the air pressure and replace the interior environment with fresh air. As the experience level of the fire service has grown, research has been conducted into new applications for PPV:

■ **High-Rise Structure Fires:** High-Rise structure fires present tremendous challenges to fire fighters. Access to a fire on an upper floor and victim escape routes can be hampered due to smoke filled stair shafts. PPV allows fire fighters to quickly clear smoke from a stair shaft so that victims have a clear path of egress and fire fighters can access the floor where the fire is located. PPV can also be used to clear the smoke from the fire floor by simply creating a path for the pressurized air.

In August of 2002, a report was issued by the National Research Council Canada titled, "Positive Pressure Ventilation for High-Rise Buildings". It

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presented the results of PPV tests conducted on a ten-story structure to determine the capabilities of PPV for clearing smoke from stair shafts and fire floors. The report concluded that PPV was effective in venting a stair shaft in a high-rise building. It also concluded that, "PPV could be used to improve conditions on the fire floor and provide improved accessibility during a fire attack." This report can be access via the internet at http://irc.nrc-cnrc.gc.ca

■ **Tunnel Fires:** In recent years, a number of widely publicized tunnel fires have increased awareness of the need to provide fast and efficient ventilation during an incident. When a vehicle inside a tunnel begins to burn, smoke and heat quickly develop to a level that makes survival impossible and access extremely difficult. By applying PPV principles, fire fighters can quickly remove the smoke and heat and create a clear path to the fire. At the same time, victims have a better chance of survival because the environment inside the tunnel begins to improve the instant that PPV is applied.

In June of 2003, a research paper on the use of PPV for emergency ventilation of a railway tunnel was published. The Swedish National Testing and Research Institute conducted the testing and research, which consisted of starting a 2.6 MW fire inside a 1km rail tunnel. One 43" truck mounted mobile ventilation unit was positioned at the tunnel entrance so that the cone of air generated by the MVU completely sealed the entrance of the tunnel. Once PPV was started, it took only 14 minutes to clear all of the smoke from the tunnel.

■ **Haz-Mat/Terrorist Response:** In the event of a chemical or terrorist attack, fire fighters are usually the first to respond. In many cases, they will be required to enter the contaminated structure to rescue victims or assess the situation. In certain situations, PPV can greatly improve the level of safety for first responders. By controlling the location of the entrance and exit openings, the environment inside the structure can be ventilated or transferred to a containment system with the assistance of a PPV blower. Once the contaminated air is removed, first responders can enter and work in a much safer environment.

In October of 1999, the United States Army published a report titled, "Use of Positive Pressure Ventilation (PPV) Fans To Reduce the Hazards of Entering Chemically Contaminated Buildings." The report concluded that PPV dramatically decreases the chemical agent vapor concentration within a structure and significantly increases the first responders' protection beyond that provided by standard personal protective equipment. This report can be accessed via the internet at: http://www.sbccom.army.mil

THE FUTURE OF PPV

The advances in PPV products and applications over the past fifteen years are the result of shared knowledge and experience among fire brigades and researchers around the world. Fire brigades throughout Europe, Asia and the Pacific Rim now use what was once a technique used primarily in the United States. While many brigades have adopted the application of PPV as a standard operating procedure, many more have yet to evaluate its benefits and applications.

It is the continued cooperation and sharing of knowledge and experience among fire brigades around the world that will advance the concept of PPV. As new applications and techniques are developed and shared, Positive Pressure Ventilation will offer greater benefits to first responders and the people they protect.

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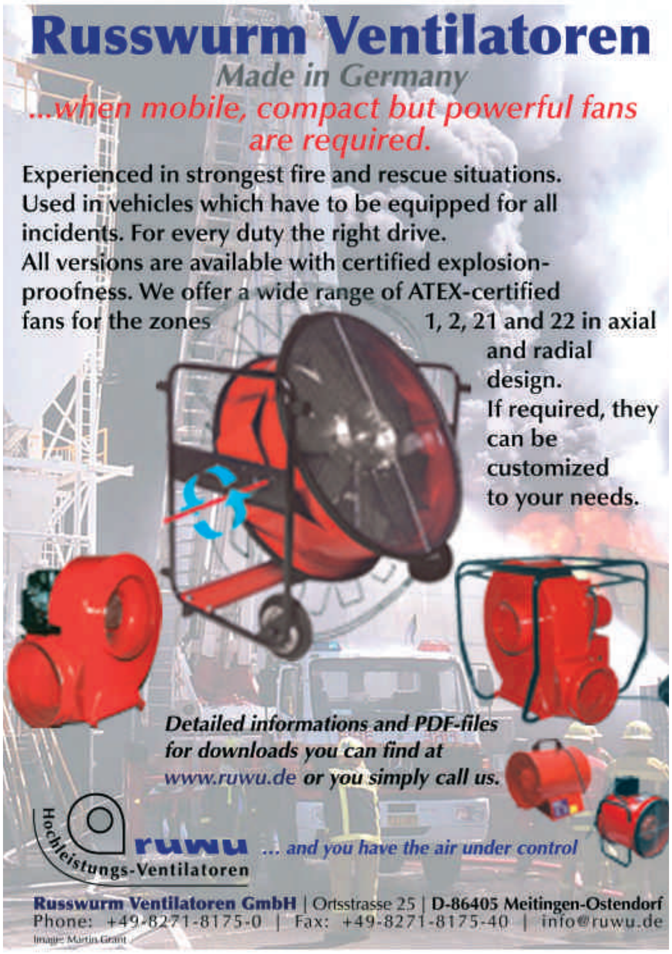
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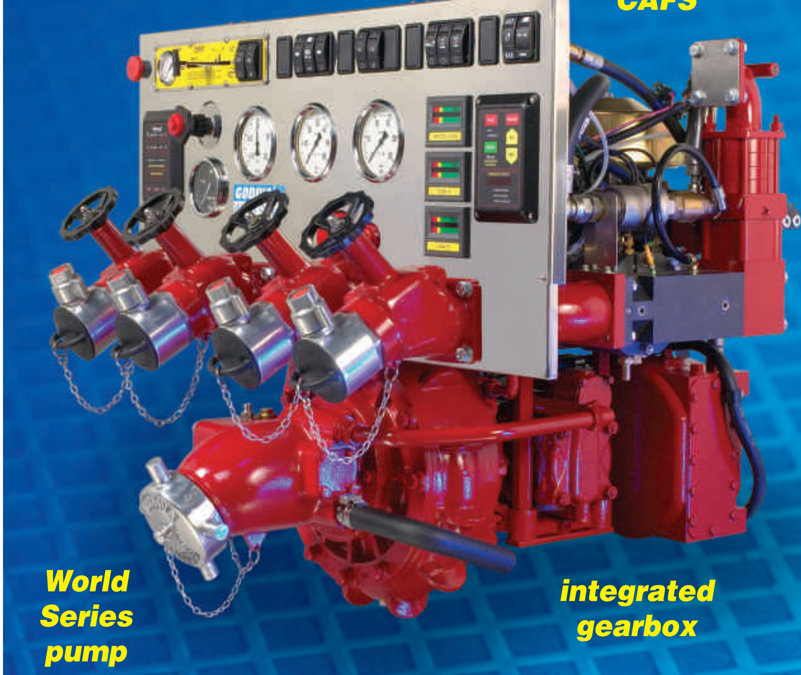

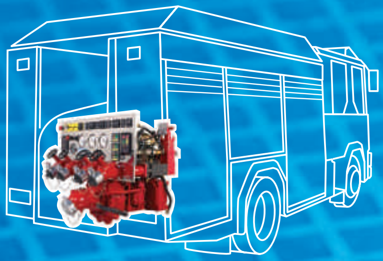

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LUKAS

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Foam Pumps & Controllers

Picture courtesy of Cutler-Hammer

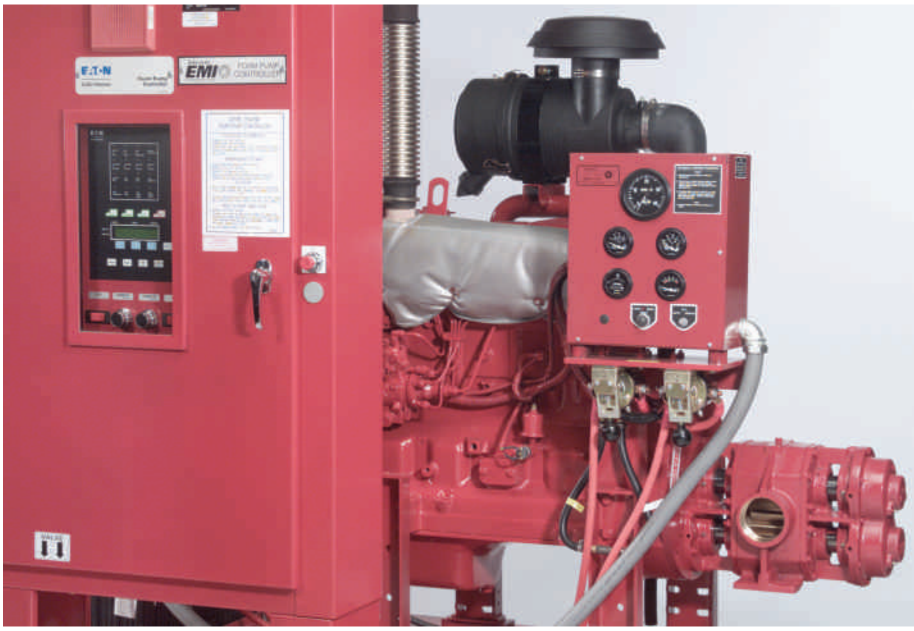
By ROB HARRIS – EATON Cutler-Hammer
Pump Controller Marketing Manager

WARREN HILL III – WEH International LLC
Director WEH

TOM RESER – Edwards Manufacturing Inc.
Director of Sales

FOAM PUMP SYSTEMS have been used for over 50 years in applications that require containment and/or extinguishing of flammable liquids. As technology has evolved, the components of the system have improved, however the basic purpose has not changed.

Foam pump controllers are an integral component in foam pump systems. To gain a better understanding of the foam pump controller, we must also look at the operation and effect the controller has within the entire system.



Picture courtesy of Cutler-Hammer

FOAM APPLICATIONS

Foam concentrate systems are designed to extinguish flammable liquids in a variety of applications where the liquids are used, stored, processed or transported. Typical installations include, petrochemical processing facilities, aircraft hangar, oil and flammable liquid cargo tankers, offshore processing platforms, liquid storage tank farms and shipboard fire fighting systems.

Installation of foam pump systems tend to be a pro-active approach to fire prevention, rather than fire extinguishing. Once a flammable liquid has been spilled and the foam system initiated, the foam typically covers the flammable liquid surface, which prevents it from igniting from a random spark. Should the foam come in contact with material that has already been ignited, the water in the foam solution turns to steam. The foam helps surround the steam with the result of a reduced amount of oxygen being available, which assists with extinguishing the burning material.

PURPOSE/OPERATION OF THE CONTROLLER

Foam Pump Controllers are designed specifically for foam service and

Picture courtesy of Cutler-Hammer

conform to NFPA 20 Chapter 7-9 requirements. The number of controllers being requested to carry UL/FM approval is growing steadily.

In a typical foam system installation there are usually two foam pump controllers. They are used as duty and standby units and are usually installed as a combination of two electric controllers; one electric and one diesel controller, or two diesel controllers.

In almost all cases (approximately 95%), the starting method for foam pump controller systems is via a manual start signal that is received from a remote pushbutton or call station.

In a non-pressurised system, once there is a call to start, both the duty and standby controllers receive the start signal. The duty controller starts to instantly flow the foam concentrate through the foam line to the foam proportioner, where it mixes with the water system and is then flowed to the hazard. At the same time, the standby controller receives its' start signal and a delay timer is energised to delay the starting of the controller. Once the duty controller has the pump up to speed, a signal is sent to the standby controller to lock it out. Should there be a failure with the duty controller, it will turn off the lock out signal being sent to the standby controller. The standby controller will now determine if there is still a call to start, and will act accordingly.

PROOF PRESSURE SWITCH

In some applications, a proof pressure switch is used to monitor the pressure in the foam line once the foam concentrate has begun to flow. Should there be a drop in pressure, (for example – the foam pump cannot keep up to the demand) the pressure switch sends a start signal to the standby controller in order to activate it. However, if the proof pressure switch does not indicate a drop in pressure in the foam line, the standby foam pump and motor will remain inactive.

If a pressurised system is used, a jockey pump and jockey pump controller are used to maintain the foam system pressure, similar to a non-foam system.

Picture courtesy of Cutler-Hammer

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As well, the foam pump controller will be equipped with a pressure switch or transducer that is used to monitor and provide the start signal, rather than a manual start signal. The controller(s) operate the same as in a non-pressurised system.

The main differences between standard Fire Pump Controllers and Foam Pump Controllers can be summarised as follows:

- The controller shall be marked “Foam Pump Controller.”
- Where required, the controller shall contain a lockout feature when used in a duty-standby application. Where supplied, the lockout function must be indicated by a visible indicator. Provisions must be made for annunciating the condition at a remote location.
- Typical options found on foam pump controllers include humidistats, space heaters, pressure recorders and NEMA 3, 4 and 4X or equivalent IPC rated enclosures.
- Types of Foam Pump Controllers include full-voltage across-the-line electric controllers, limited service controllers, power transfer switch electric controllers and diesel engine controllers.
- All models must comply with NFPA 20 section 7-9 – “Controllers for Foam Concentrate Pump Motors”.
- Most controllers carry various approval listings, which may include FM (Factory Mutual), UL, ULC, CSA, CE, LPC etc.

DIFFERENCES BETWEEN DIESEL AND ELECTRIC FOAM CONTROLLERS

There is very little difference between an electrical foam and diesel engine foam pump system. Both are equipped with the necessary components to control the liquid foam concentrate required to prevent ignition of the flammable liquid. This will include a foam concentrate tank, UL/FM approved positive displacement foam pump, UL/FM approved pump driver (foam pump controller) and all the associated piping, valves, fittings and gauges as required by NFPA 20 Chapters 5 and 7-9.

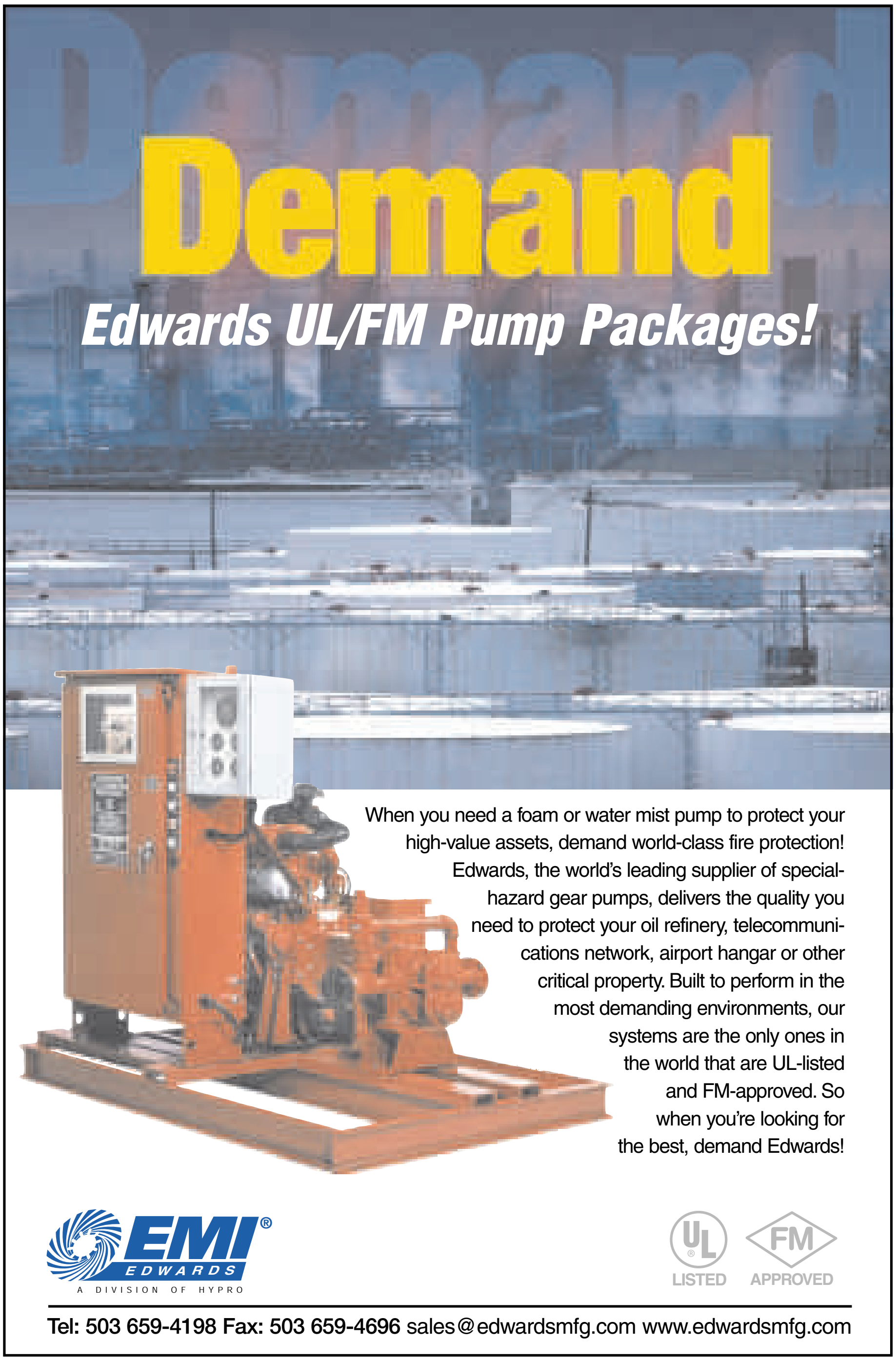
DIESEL SYSTEM VS ELECTRIC

There are installation sites where the electrical service is not available or has been deemed unreliable. In these instances, a self-contained (except for a single phase 120V/220V, 50/60Hz power source for the battery chargers) diesel engine foam pump system is available.

In some cases, since the system is always under pressure and a positive displacement pump is used, the diesel engine may not have enough torque to rotate the pump shaft.

A remedy to this condition is to relieve the pressure in the foam concentrate system line by the use of a “dump” valve.

Picture courtesy of Cutler-Hammer



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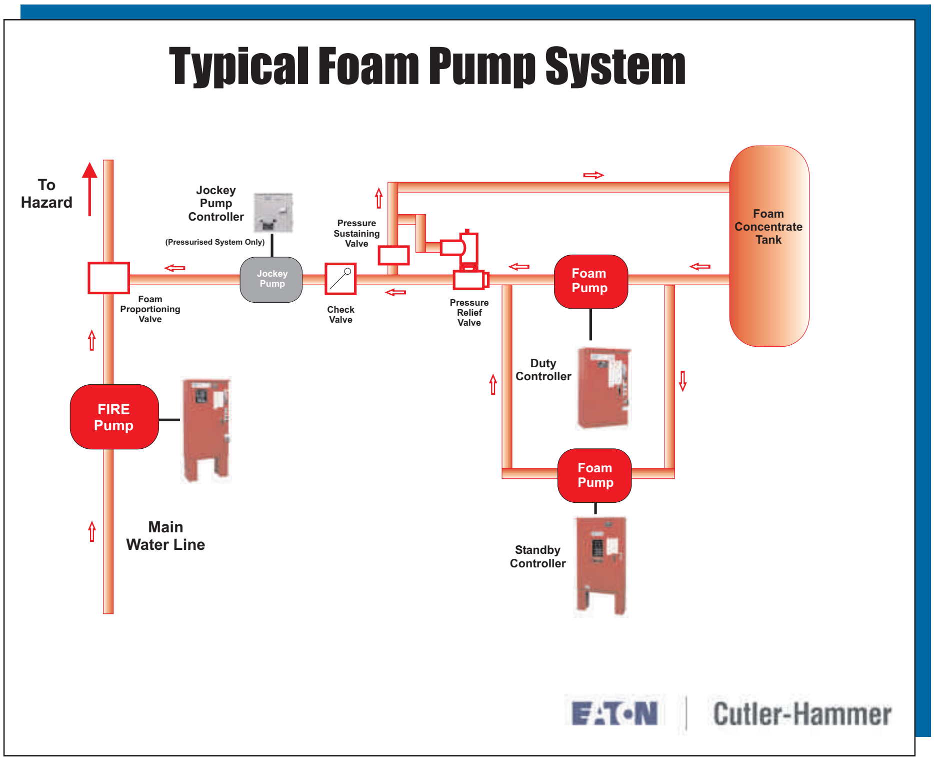

Picture courtesy of Cutler-Hammer

The dump valve receives a crank signal from the controller while it is sending a crank signal to the engine. The valve opens and relieves pressure by draining the concentrate back to the concentrate storage tank.

Once the engine has come up to it's running speed, the engine speed switch provides a "pump running" signal which simultaneously de-energises the dump valve. The foam concentrate now enters the water stream where it mixes and flows to the hazard location.

LIMITED SERVICE FOAM PUMP CONTROLLERS

Limited service foam pump controllers are used when the application calls for a low horsepower of 30HP or less. As well, most foam pump engines used in diesel applications are listed up to 105HP only, as larger size engines and motors are not required to drive the foam pumps.

ADVANTAGES OF MICROPROCESSOR BASED CONTROLLERS FOR FOAM APPLICATIONS

The inherent features of standard microprocessor based controllers apply to foam pump controllers as well. This can include long lasting LED indicators rather than pilot lights that burn out over time.

All events surrounding the operation of the controller are stored within the controller, thus giving the ability to diagnose and troubleshoot problems based on an actual history of events. Events are time and date stamped and can be printed or downloaded to a laptop computer or floppy disk, rather than using a strip chart recorder that is difficult to read and analyse.

A main display unit will typically give a read out of parameters such as current pressure, volts and amps and will display error messages as well as provide alarm indication.

A status report is usually available from microprocessor based units and can also be printed or downloaded to a laptop computer or floppy disk. The status reports provide a record of the state of the controller as it was left after commissioning.

The stainless steel pressure transducer used for sensing pressure in the foam line can be installed directly onto the foam line, which can eliminate the need for a pressure line to be run into the controller. This will eliminate the installation of an additional proof pressure switch and reduce the overall cost of the installation.

Microprocessor based controllers have the ability to include extra relays that can be programmed for a wide range of functions with the microprocessor. This is a useful feature to have when on-site installation requirements are suddenly modified.

Microprocessor based controllers have the ability to include extra relays that can be programmed for a wide range of functions with the microprocessor. This is a useful feature to have when on-site installation requirements are suddenly modified.

CONCLUSION

UL/FM listed foam pump systems and the controllers that operate them, provide a vital method of containing flammable liquids in a variety of hazardous situations. In turn, they protect property that can cost a substantial amount of money to replace (ranging into the millions of dollars) and they ultimately save lives, in some of the most volatile fire protection applications that exist. Therefore, it is imperative that the foam system and the controllers operate when required, and that the specifying authority takes into account life safety, as well as the long term financial and economic implications of the loss of operational capabilities, when choosing a foam pump system.

MARKET LEADERS

IN MICROPROCESSOR BASED FIRE PUMP CONTROLLERS

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For over 50 years, EATON Corporation has been the industry leader in Medium Voltage Motor Control. The FDM Medium Voltage Fire Pump Controller is based on the AMPGARD® controller design which incorporates Eaton's industry leading Cutler-Hammer TRITON™ SL Series Medium Voltage Vacuum Contactor. The SL Contactor utilizes Cutler-Hammer's vacuum interrupters that exhibit both a long electrical life and a high interruption capacity.

FDM MEDIUM VOLTAGE CONTROLLERS

Standard Features

- Components and Power Connections: Front Accessible
- Wire Connections: Reduced 50% using Component-to-Component direct connection
- Enclosures: NEMA 2, 3R, 4, 4X, 12
- Contactor: Industry leading Cutler-Hammer SL-400
- Fuses: Fatigue-Proof Current Limiting
- Isolation: No access to MV component section when powered
- Grounding: Tin Plated Copper Bus
- Operating Devices: Cutler-Hammer NEMA Rated - Oil & Dust Tight
- Space Heater: Powered from Test Circuit - Supplied as Standard

LMR ELECTRIC CONTROLLERS

LMR ELECTRIC CONTROLLERS

Standard Features

- Microprocessor Control
- Pressure, Voltage & Current Display
- Alarm & Status LED Indication
- LCD Message Retrieval – Last 2048 Messages
- Pressure Transducer - 600 PSI Max.
- Printer – Recorder
- Elapsed Time Meter
- Number of Operations Counter
- Run Period Timer
- Sequential Start Timer
- Weekly Test Timer
- Common Alarm Relay & Contacts
- NEMA 2 Enclosure
- NEMA Rated Contactors
- Emergency Start Operator
- Extra Set of Form-C Contacts for Phase Reversal & Phase Failure
- Additional Output Relay
- Pre-Wired Terminals for Remote Start Deluge Valve, Relief Valve Discharge
- Low Suction Pressure & Interlock

DIESEL ENGINE CONTROLLERS

DIESEL ENGINE CONTROLLERS

Standard Features

- Microprocessor Control
- Pressure, Voltage & Current Display
- Alarm & Status LED Indication
- LCD Message Retrieval – Last 1024 Messages
- Pressure Transducer – 600 PSI Max.
- Printer – Recorder
- Run Period Timer
- Sequential Start Timer
- Weekly Test Timer
- Common Alarm Relay & Contacts
- NEMA 2 Enclosure
- 120V or 220V Power Supply Input
- 12V or 24V Power Output

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HANDLINE NOZZLES: MARKET GUIDE

AKRON BRASS COMPANY

MODEL NUMBER				
PRODUCT NAME	**Turbojet**	**Assault**	**SaberJet**	**Coast Guard/Industrial**
ORIGIN	USA	USA	USA	USA
TYPE OF NOZZLE	Selectable Flow	Fixed Orifice	Multi-Purpose	Fixed Orifice
SIZES AVAILABLE	1",1½",1¾",2½"	1",1½",1¾",2½"	1",1½",1¾",2½"	1½" & 2½"
CONFIGURATIONS	Std. nozzle, pistol grip, tips, breakaparts	Std. nozzle, pistol grip, tips, breakaparts	Std. nozzle, pistol grip	Std. nozzle, pistol grip
MATERIAL USED FOR NOZZLE	Pyrolite	Pyrolite	Pyrolite	Brass
WEIGHT	2¼ to 7⅛ lbs.	1¾ to 7⅝ lbs.	5 to 6½ lbs.	7⅛ to 13 lbs.
QUOTED OUTPUT RANGE (LPM)	13 to 250 gpm	13 to 350 gpm	23 to 266 gpm	95, 125, & 250 gpm
DELIVERY TIMES	1 to 6 weeks	1 to 6 weeks	1 to 6 weeks	4 to 6 weeks
UNIQUE FEATURE	1. Easy flow control. 2. Excellent streams at various pressures 3. Wide dense fog patterns. 4. Both 75 & 100 psi versions. 5. High pressure 1" version. 6. Spinning fog teeth. 7. Pattern detents. 8. Meets NFPA 1964.	1. Excellent streams at various pressures. 2. Wide dense fog patterns. 3. Available in 50, 75 & 100 psi versions. 4. High pressure 1" version. 5. Spinning fog teeth. 6. Pattern detents. 7. Meets NFPA 1964. 8. Low maintenance.	1. Combination smooth bore and fog in one nozzle. 2. Change from smooth bore to fog while flowing. 3. Wide dense fog pattern. 4. Operate from 50 to 100 psi. 5. Spinning fog teeth. 6. Pattern detents. 7. Meets NFPA 1964.	1. Corrosion resistent red brass construction. 2. Coast Guard approved. 3. Adjustable spray pattern. 4. Durable, low maintenance design.
WARRANTY	10 Year	10 Year	10 Year	5 Year

Akron Brass Company
343 Venture Blvd.
Wooster, OH 44691, USA
Tel: +1 330 264 5678
Fax: +1 330 264 2944
Website: www.akronbrass.com

AWG

MODEL NUMBER	**4002/4005**	**4200**	**4300**	**4403**	**4600**
PRODUCT NAME	**Multi purpose Nozzle**	**HS Nozzles**	**Turbo Nozzles**	**Pistol Nozzles**	**High pressure pistols**
ORIGIN	Germany	Germany	Germany	Germany	Germany
TYPE OF NOZZLE	Jet/spray/shut-off	Jet/spray/shut-off	Select flow	Select flow	Jet/spray
SIZES AVAILABLE	1", 2", 2.5"	1",2"	1",1½",2",2½"	1½",2"	1"
MATERIAL USED FOR NOZZLE		Aluminium / stainless steel / high grade polyamide / rubber			
WEIGHT		Depending on size and coupling type			
QUOTED OUTPUT RANGE (LPM AT 6 BAR)	Option between 24 and 955 l/min"	Option between 150 and 410 l/min"	Option between 40 and 950 l/min"	40 and 130 l/min	60 and 80 l/min
DELIVERY TIMES		Products produced in series			
UNIQUE FEATURES	Full jet and spray	Light weight short version	pointers flow and spray	pointers flow and spray motion control	motion control
WARRANTY		24 month			

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Lederstrasse 30-36
D-89531 Giengen/Brenz, Germany
Tel: +49 7322 145 8
Fax: +49 7322 145 29
Website: www.awg-giengen.de

ELKHART BRASS

MODEL NUMBER	**SM-20FLP**	**SM-30FLP**
PRODUCT NAME	**SM-20FLP Select-O-Matic Low Pressure Nozzle**	**SM-30FLP Select-O-Matic Low Pressure Nozzle**
ORIGIN	USA	USA
TYPE OF NOZZLE	Select-O-Matic Low Pressure Nozzle	Select-O-Matic Low Pressure Nozzle
SIZES AVAILABLE	1.5" only	1.5" only
MATERIAL USED FOR NOZZLE	Elk-O-Lite Aluminum	
WEIGHT	5.375 lbs.	7.25lbs
QUOTED OUTPUT RANGE (LPM)	60-200GPM @ 75 PSI	75-325 GPM @ 75 PSI
DELIVERY TIMES	10 working days	10 working days
UNIQUE FEATURES	Automatically Adjusts to Flucuating Flows, Constant Flow-Flush Feature	Automatically Adjusts to Flucuating Flows, Constant Flow-Flush Feature
WARRANTY	5 yrs	5 yrs

Elkhart Brass Mfg. Co., Inc.
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Elkhart
IN 46515
USA
Tel: +1 574 295 8330
Fax: +1 574 293 9914
Website: www.elkhartbrass.com

HANDLINE NOZZLES: MARKET GUIDE

NORDIC SYSTEMS, INC

MODEL NUMBER	760330	760340	760310	760300	760320
PRODUCT NAME	**Over Under Dual Agent Handline Nozzle**	**Over Under Dual Agent Air Aspirated Handline**	**Foam Nozzle**	**Dry Chemical Handline**	**Foam Nozzle**
ORIGIN	Nordic Foam Boss	Nordic Foam Boss	Nordic Foam Boss	Nordic Foam Boss	Nordic Foam Boss
TYPE OF NOZZLE	Combined Standard Dry Chem & Water/Foam	Dry Chem & Water/Foam	TET Twister	Dry Chemical	Aspirated Foam
MATERIAL USED FOR NOZZLE	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum
WEIGHT	10 lbs	11.2 lbs	5 lbs	5 lbs	6.2 lbs
QUOTED OUTPUT (LPM)	230 lpm (3.6 kg/sec)	230 lpm (3.6 kg/sec)	230 lpm	3.6 kg/sec	230 lpm
DELIVERY TIMES	30 days	30 days	30 days	30 days	30 days
UNIQUE FEATURES		air aspirated foam nozzle			air aspirated foam nozzle
WARRANTY	1 year	1 year	1 year	1 year	1 year

Nordic Systems Inc
1044 Rangeview Road
Mississauga (Toronto), Ontario
Canada L5E 1H3
Tel: +1 905 278 3331
Fax: +1 905 278 5197
Email: info@nordicsystems.com
Website: www.nordicsystems.com

PROTEK

MODEL NUMBER	366	372-BC	312
PRODUCT NAME	**Handline Nozzle**	**Handline Nozzle**	**Handline Nozzle**
ORIGIN	Taiwan	Taiwan	Taiwan
TYPE OF NOZZLE	Selectable Flow	Marine Nozzle	Automatic Nozzle
SIZES AVAILABLE	1",1-½",2-½"	1-½",2-½"	1-½",2-½"
CONFIGURATIONS	Pistol Grip Included	Pistol Grip Included	Pistol Grip Included
MATERIAL USED FOR NOZZLE	Lightweight Alloy	Bronze	Lightweight Alloy
WEIGHT	1.5 kg	3.5 kg	2.5 kg
QUOTED OUTPUT RANGE (LPM)	115-475	230-475	230-750
DELIVERY TIMES	2 weeks	2 weeks	2 weeks
UNIQUE FEATURES	FM Approval	Trouble free for Marine Use	Very Low Maintenance Require
WARRANTY	Worldwide - 5 years	Worldwide - 5 years	Worldwide - 5 years

Protek Manufacturing Corp.
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Website: www.protekfire.com

R. PONS

MODEL NUMBER	**Depends on inlet type**	**Depends on inlet type**	**Depends on inlet type**	**Depends on inlet type**	**Depends on inlet type**
PRODUCT NAME	**OPTRAPONS 150**	**OPTRAPONS 500RM**	**OPTRAPONS 500RT**	**OPTRAPONS 1000RM**	**OPTRAPONS 300/500**
ORIGIN	France	France	France	France	France
TYPE OF NOZZLE	Spray/jet nozzle with adjustable flow-rate	Spray/jet nozzle with adjustable flow-rate	Spray/jet nozzle with adjustable flow-rate	Spray/jet nozzle with adjustable flow-rate	Spray/jet nozzle with fixed flow-rate
SIZES AVAILABLE	1"	1½"	1½"	2½"	1½"
CONFIGURATIONS	Pistol Grip, No Pistol Grip, Tip Only	Pistol Grip, No Pistol Grip, Tip Only	Pistol Grip, No Pistol Grip, Tip Only	Pistol Grip, No Pistol Grip, Tip Only	Pistol Grip, No Pistol Grip, Tip Only
MATERIAL USED FOR NOZZLE	Anodized aluminium	Anodized aluminium	Anodized aluminium	Anodized aluminium	Anodized aluminium
WEIGHT	1,48 Kg (pistol grip model)	2,53 Kg (pistol grip model)	2,56 Kg (pistol grip model)	7,9 Kg (dual handles model)	2,59 Kg (pistol grip model)
QUOTED OUTPUT (LPM)	30 to 150l/mn	125 to 500l/mn	125 to 500 l/mn	375 to 1000l/mn	300 or 500 l/mn
DELIVERY TIMES	Depends on quantity	Depends on quantity	Depends on quantity	Depends on quantity	Depends on quantity
UNIQUE FEATURES	High and low pressure model :PN 40 Flash-over position	Fixed teeth model. Flash-over position. Specific flow positions for foam (200 and 400 l/mn) to use the nozzle as a foam nozzle with or without foam adapter	Spinning teeth model. Flash-over position. Specific flow positions for foam (200 and 400 l/mn) to use the nozzle as a foam nozzle with or without foam adapter	Fixed teeth model. Flash-over position. Dual handles	Fixed teeth model. Flash-over position. Specific flows on request.
WARRANTY	5 years	5 years	5 years	5 years	5 years

R.Pons
5 Place Du Colonel Fabien
75010 Paris, France
Tel: +33 1 53 38 86 82
Fax: +33 1 53 38 86 99
Website: www.rpons.fr

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Phone: 6622596899
Fax: 6622582422
sithichai@antifire.com

HANDLINE NOZZLES: MARKET GUIDE

TASK FORCE TIPS

MODEL NUMBER	**B-BH, B-BGH, BTO-125, BH-125, BGH-125**	**DQ40, DQS40, DQS40P, FQ125, FQS125, FQS125P**	**FT200, FTS200, FTS200P, FT250, FTS250, FTS250P**	**HMD-TO, HMD-STO, HMD-V, HMD-VPGI**	**HD-TO, HD-STO, HD-V, HD-VPGI, HD-VPG**
PRODUCT NAME	**Ultimatic**	**QuadraFog**	**ThunderFog**	**Mid-Force**	**Dual-Force**
ORIGIN	Made In The USA	Made In The USA	Made In The USA	Made In The USA	Made In The USA
TYPE OF NOZZLE	Full Automatic 7 bar Handheld Nozzle	Selectable Gallonage	Selectable Gallonage	Dual Pressure Automatic	Dual Pressure Automatic
SIZES AVAILABLE	19mm, 25mm and 38mm	25mm and 38mm	38mm and 64mm	38mm	38mm and 64mm
CONFIGURATIONS	Slide Valve, With or Without Pistol Grip	Tip Only, Ball Valve Shutoff, . Ball Valve Shutoff with Pistol Grip	Tip Only, Ball Valve Shutoff, . Ball Valve Shutoff with Pistol Grip	Tip Only, Tip with shutoff, Slide Valve, Slide Valve with Pistol Grip	Tip Only, Tip with shutoff, Slide Valve, Slide Valve with Pistol Grip
MATERIAL USED FOR NOZZLE	Lightweight hardcoat anodized aluminum.	Lightweight hardcoat anodized aluminum.	Lightweight hardcoat anodized aluminum.	Lightweight hardcoat anodized aluminum.	Lightweight hardcoat anodized aluminum.
WEIGHT	1.1 - 1.5 kg	0.6 - 1.6 kg	1.7 - 2.5 kg	1.4 - 2.2 kg	2.1 - 4.5 kg
QUOTED OUTPUT RANGE (LPM)	40 - 500 l/min	20,40,100,150 l/min @ 7 bar or 110, 230, 360, 470 l/min @ 7 bar	110, 230, 360, 470, 570, 750 l/min @ 7 bar or 360, 470, 570, 750, 950 l/min @ 7 bar	260-760 l/min @ 7 bar	265-960 l/min @ 7 bar
DELIVERY TIMES	1-4 weeks	1-4 weeks	1-4 weeks	1-4 weeks	1-4 weeks
UNIQUE FEATURES	Flush without shutting down. Six position detent flow control slide valve, "Gasket Grabber" inlet screen. Molded rubber bumper. Power fog teeth. Optional colored pistol grip.	Tip only has on/off for break and extend. Four flow settings. Flush without shutting down. Molded rubber fog teeth or stainless steel spinning teeth. Optional colored pistol grip.	Tip only has on/off for break and extend. Four flow settings. Flush without shutting down. Molded rubber fog teeth or stainless steel spinning teeth. Optional colored pistol grip.	Flush without shutting down. Six position detent flow control slide valve. "Gasket Grabber" inlet screen. Molded rubber bumper. Power fog teeth. Optional colored pistol grip. Nozzle may be switched between Standard 7 bar and low pressure 3 bar.	Flush without shutting down. Six position detent flow control slide valve. "Gasket Grabber" inlet screen. Molded rubber bumper. Power fog teeth. Optional colored pistol grip. Nozzle may be switched between Standard 7 bar and low pressure 3 bar.
WARRANTY	Task Force Tips warranty's that our equipment shall be free from defects in material and workmanship for a period of five years from the date of purchase	Task Force Tips warranty's that our equipment shall be free from defects in material and workmanship for a period of five years from the date of purchase	Task Force Tips warranty's that our equipment shall be free from defects in material and workmanship for a period of five years from the date of purchase	Task Force Tips warranty's that our equipment shall be free from defects in material and workmanship for a period of five years from the date of purchase	Task Force Tips warranty's that our equipment shall be free from defects in material and workmanship for a period of five years from the date of purchase
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ZR ARMATUREN

MODEL NUMBER	**504122**	**500122**	**546991**	**502302**	**228301**
PRODUCT NAME	**FIREJET II**	**AQUAJET II**	**JET**	**HD 40**	**Multipurpose branchpipes DIN 14365 with water curtain Device**
ORIGIN	Germany	Germany	Germany	Germany	Germany
TYPE OF NOZZLE	Handline-nozzle	Handline-nozzle	Pistol nozzle	High pressure pistol	Multipurpose branchpipe
SIZES AVAILABLE	2" male thread	2" male thread	2" male thread	1" female thread	2" and 2½" male thread
CONFIGURATIONS	Storz System, British Standard Connection or other systems	Storz System, British Standard Connection or other systems	Storz System, British Standard Connection or other systems		Storz System, British Standard Connection or other systems
MATERIAL USED FOR NOZZLE	Aluminium Alloy	Aluminium Alloy	Aluminium Alloy	Aluminium Alloy	Aluminium Alloy
WEIGHT	started from 2.500 g depending from type	started from 2.500 g depending from type	started from 2.075 g depending from type	2.300 g	started from 1.520 g depending from type
QUOTED OUTPUT RANGE (LPM)	130-235-400 lpm	60-130-235 lpm	75 / 115 lpm	150 lpm	from 120 until 955 lpm
DELIVERY TIMES	depending from quantities	depending from quantities	depending from quantities	depending from quantities	depending from quantities
UNIQUE FEATURES	The nozzle meet the new standard DIN 14367 for branchpipes. The flow rates can be selected by the adjusting sleeve and opening and closing by means of the lever	The nozzle meet the new standard DIN 14367 for branchpipes. The flow rates can be selected by the adjusting sleeve and opening and closing by means of the lever	With built-in damping device for quick attack hose reels. Control facility at the water outlet allows switching from full discharge to infinitely variable spray angle up to 90°	Infinitely adjustable from variable spray to full jet, by twisting the hand grip an interposition creates a flat stream. An internal hydraulic damping device prevents unpleasant pressure shocks	Tube with hand protection. Spray infinitely variable from 0-170° to protect the fireman. Also with jet lock = VS
WARRANTY	6 months	6 months	6 months	6 months	6 months
ZR-Armaturen GmbH Gotenstrasse 23 D 65929 Frankfurt Germany Tel: +49 69 314 075 0 Fax: +49 69 314 075 88 Website: www.zr-armaturen.de					

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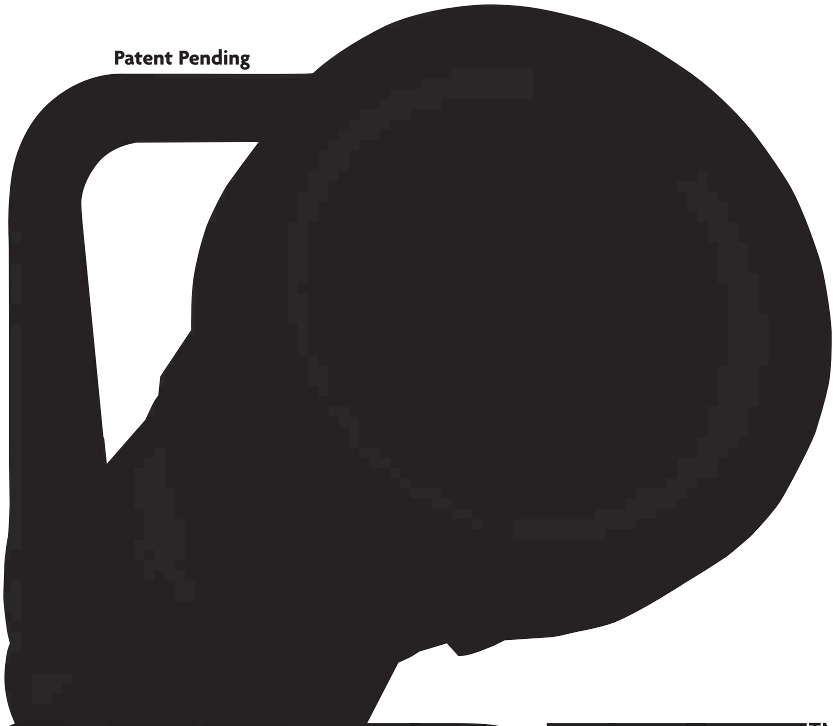

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Special Hazard Suppression System

by I.S. Iswar
Tyco Fire & Security Asia

Picture courtesy of Tyco Fire & Security Asia

The consequences of a fire, even a small one, have a greater impact today than the same size of fire ten or even five years ago.

> "Industry studies show that 43% of business closed by a significant fire never reopen and another 29% fail within 3 years." Study by the Network Reliability and Interoperability Council, an organization established by the Federal Communications Commission found that advances in technology have created a higher level of risk exposure and greater vulnerability to a fire.

Special hazards are defined by:

- High value and high risk
- Virtually zero tolerance to downtime occasioned by fire damage or cleanup
- No possibility of replacement of protected items (e.g. irreplaceable art work)
- Inability to operate vital equipment and business processes after a fire.

Special Hazards Fire Suppression System has to address the fire protection for both the structure of the building and the assets its contains. Special Hazards extinguishants include Clean Agent, Water mist, Carbon Dioxide, Foam and Dry Chemical Systems.

Published standards and equipment specifications should be referred to for proper designing and engineering of Special Hazards Systems.

CLEAN AGENT

The 1993 revision of Montreal Protocol covering substances, which resulted in depletion of stratospheric ozone layer, leads to the cessation of production of fire fighting Halons by the end of 1993.

NFPA 2001 *"Standard on Clean Agent Fire Extinguishing System"* defines Clean Agent as an electrically non-conducting, volatile or gaseous fire extinguishant that does not leave residue upon evaporation.

When selecting a gaseous extinguishing system the fire protection and safety engineer faces number of choices. The agents may be categorized into two different groups, Halocarbon Agent and Inert Gas Agent.

Halocarbon Agent contains as primary components, one or more organic components containing one or more of the elements Fluorine, Chlorine, Bromine or Iodine, Examples are Hydrofluorocarbons (HFC's), Hydrochlorofluorocarbons (HCFC's), Perfluorocarbons (PFC's) and Fluorocarbons (FC's) and Iodocarbon (IC's). Halocarbon Agents act largely by heat absorption, although having some chemical effect on the flame combustion reactions.

Inert Gas Agent contains one or more of the gases like Helium, Neon, Argon, and Nitrogen as primary components. Inert gas agents that are a blend of gaseous mixtures can also contain carbon dioxide as a secondary component. Inert gas type agent controls fires by depleting oxygen concentration in the atmosphere of the enclosure to a point below a level that will support combustion.

Total Flooding Clean Agent Fire Extinguishing systems are used primarily to protect hazards that are in enclosures or equipment that can retain the agent. Typical hazards that could be suitable include computer rooms, clean rooms, EDP facilities, flammable combustible liquids stores, telecommunication facilities, health care facilities, museums or other facilities containing irreplaceable objects.

At design concentration, clean agents are SAFE for people.

The primary objectives are extinguishment of all occurrences of fire, limiting the propagation of the fire and fire damage, preventing re-ignition for a specific period and the interruption

Special Hazard Suppression System

of vital equipment and business processes after a fire.

Room Integrity testing has become an important feature in the commissioning of gaseous fire fighting systems. The Integrity test is performed to check that enclosures can maintain an extinguishing concentration for a sufficient period of time (typically 10 minutes) following discharge to prevent re-ignition. Room integrity is now a requirement of ISO 14520 and NFPA 2001 at the commissioning stage.

NOVEC 1230

NOVEC 1230 is a fluorinated ketone manufactured by 3M. It has low toxicity and a boiling point of 48°C and therefore exists as a liquid at room temperature. It is super pressurized with nitrogen to 25 bar (360 psi). It rapidly extinguishes fire through a combination of mainly heat absorption and chemical interference with the flame. NOVEC 1230 can be used for both streaming and flooding applications.

With zero ozone depletion, negligible GWP and ALT (Atmospheric Life Time) of less than 5 days, NOVEC 1230 fluid is considered to be the "first Halon replacement to offer a viable, long-term sustainable technology for Special Hazards Fire Protection applications."

Typical design concentration for Class B fire is 5.5%. The NOAEL is 10% and the LOAEL is greater than 10%. Where high margins of safety are considered to be crucial, NOVEC 1230 outperforms the other halocarbon agents.

NOVEC 1230 complies with the Chemical Notification requirements of Canada (CSDL), Korea (KECI), Australia (AICS), Europe (ELINCS), USA (TSCA) and China (CICS).

Tyco's NOVEC 1230 Fixed Extinguishing System is approved by RINA (Italian Marine Authority), MCA, LRS, BV, DNV and LPCB. ABS, GL and USCG approvals are in progress. NOVEC 1230 is also submitted for inclusion in ISO, CEN and NFPA 2001.

MICRO-K® PARTICULATE AEROSOL SYSTEM

The technology behind aerosol fire extinguishing agents was first developed by the aerospace industry in an effort to solve fire problems in the vicinity of the launch pad. Ansul successfully harnessed the extinguishing power of this agent for a variety of applications. The MICRO-K® system uses solid aerosol technology suitable for total flooding of unoccupied areas to suppress Class B, C, and surface Class A type fires. Typical applications include flammable liquid storage, pump rooms, switch gear rooms, transformer rooms, paint lockers, cell sites, engine rooms etc.

MICRO-K® agent is stored in solid form inside a triple-chamber steel housing called a "generator." When fire is detected, an actuator imbedded in the agent starts a chemical reaction that generates a gaseous product that quickly condenses into particles that are smaller than that of dry chemical. This particulate aerosol escapes from the generator where it easily mixes with the air throughout the hazard area. The aerosol particles break the combustion chain reaction thereby extinguishing the fire.

How does a MICRO-K® system compare to other gaseous agents?

The low weight-to-extinguishing capability of MICRO-K® agent provides tremendous performance advantages for weight/space critical applications. A CO_2 cylinder weighing 150 kg could be replaced with about 4 kg of agent. The aerosol requires only 25% of agent mass of Halon 1301. Typical design concentration is 1.1 kg of aerosol for 9.4 cubic meters of protected volume for Class B/C fires (including 20% safety factor).

The MICRO-K® system is ULC, SSL, MCA and DSA approved.

CARBON DIOXIDE SYSTEMS

Carbon Dioxide is colorless, odorless, electrically non-conducting and an effective extinguishing agent for Class A, B, and C fires. It extinguishes the fire by reducing the concentration of the oxygen in a room to below that required for sustaining combustion. It is 1.5 times heavier than air.

In fire protection systems, carbon dioxide is stored in liquid form in high pressure cylinders or low pressure insulated, refrigerated containers, capable of maintaining the CO_2 in its liquid state at 0 Deg F and 300 psi.

NFPA 12 standards on Carbon Dioxide Extinguishing Systems recognize 4 types of Carbon Dioxide Systems:

> *The Integrity test is performed to check that enclosures can maintain an extinguishing concentration for a sufficient period of time (typically 10 minutes) following discharge to prevent re-ignition.*

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Special Hazard Suppression System

- Total Flooding
- Local Application
- Hand Hose lines
- Standpipe Systems with mobile supply

Total Flooding Systems are suitable for Surface fires (fire on the exterior of the object, e.g. typically liquid fuels) and Deep seated fires (a fire within an object or enclosure, e.g. electrical gear, wiring insulation).

Total Flooding Systems are suitable for Surface fires (fire on the exterior of the object, e.g. typically liquid fuels) and Deep seated fires (a fire within an object or enclosure, e.g. electrical gear, wiring insulation).

Local application is considered in spaces too large for Total Flooding System or when a Total Flooding system could impair human life or in enclosures incapable of holding the agent (Dip tanks, Quench Tanks, Rolling Mills, Spray Booths etc).

The concentration at which Carbon Dioxide is discharged into an enclosure in Total Flooding System is a minimum 34% by volume for Surface fires and 50% for deep-seated fires.

WATER MIST SYSTEMS

Water mist system is an automatic water-based fire suppression system with nozzles capable of providing fine droplets.

NFPA 750 standards for the installation of water mist fire protection systems defines a water mist as a fine water spray with water droplets of less than 1000 micron at a distance of 3.3 ft (1m) from the discharge nozzle.

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Picture courtesy of Tyco Fire & Security Asia

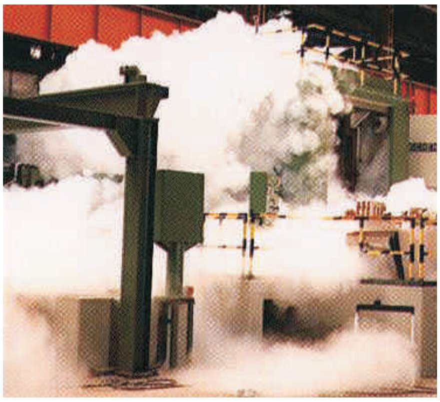
The droplets are small enough to penetrate all areas beyond obstructions yet large enough to penetrate the surface of the hot or burning fuel. The performance objectives that form the basis for system selection and design include heat removal, fire control and temperature control.

Typical water mist applications include cable tunnels, turbine enclosures, switchgear rooms and engine rooms, flammable storage and ships.

System may use only water, water and compressed air or nitrogen, as an atomizing media. The quantity of water required for water mist system can be up to 100 times less than that in sprinkler system.

Presently there is no ‘cookie-cutter; approach for the design and calculation of water mist systems. Choice of the system is dictated by the performance objectives and matching it with performance criteria of the equipment offered by the manufacturer.

Water mist is an emerging technology and holds a strong potential as a Halon replacement.



Picture courtesy of Tyco Fire & Security Asia

FOAM SYSTEMS

Fire Fighting Foam is a stable mass of small air filled bubbles with lower density than oil, gasoline or water.

Fire fighting foam suppresses fires by separating the liquid fuel from the air (oxygen) depending upon the type of agent this is done in several ways:

1. It reflects and absorbs radiant heat from the flames and prevents it from reaching the surface.
2. Forms a seal or blanket over the fuel surface, which retains the vapor and blocks oxygen supply for the fuel.
3. Cools the fuel surface below its

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Special Hazard Suppression System

Picture courtesy of Tyco Fire & Security Asia

boiling point and the adjacent heat and the ignition sources.

4. Generates steam and dilutes the oxygen concentration, thus smothering the fire.

Foams are classified by NFPA 11 standards for low expansion foams, according to their expansion ratio (ratio of volume of foam formed to a volume of solution used). Low expansion foam is in the expansion range of 1:20. Medium and high expansion foam are in the range of 21 to 200 and 201 to 1000 respectively.

The various types of foam concentrates are Protein foam, Fluoroprotein, Aqueous Film Forming Foam (AFFF), Alcohol Resistant Concentrate (ARC).

The foam concentrate percentage refers to the amount of concentrate that is proportioned or premixed with water to give the resulting foam solution (typical concentrations are 1%, 3% and 6%).

The type of foam system normally used include:

1 Overhead Spray System

Low expansion foam agent used with aspirating or non-aspirating nozzles to protect pool or spill fire hazards e.g. Dip tanks, quench tanks, aircraft hangars etc.

2 Storage Tanks

Top Pourer Floating Roof and Base injection.

3 Vapor Suppression System

If used with High Expansion foam equipment it acts as a vapor suppressant in fuels such as LNG & Cryogenic.

4 Total Flooding System

High Expansion systems are designed to protect large volume enclosures containing Class 'A' fuel.

> *The surface coating ability of dry chemical is effective for three dimension fires, like spray fires and especially elevated objects and objects with vertical surfaces where rundown of other agents will provide only partial protection.*

DRY CHEMICAL SYSTEMS

A Dry Chemical agent consists of very small powder particles that are suspended in a gaseous medium, which permits distribution of the powder to a hazard.

Popular applications are Purple K (Potassium bicarbonate) Super K (Potassium Chloride) and Monnex Urea based (Potassium bicarbonate).

Dry chemical agents provide rapid flame knock down to limit the fire spread and flame damage.

The surface coating ability of dry chemical is effective for three dimension fires, like spray fires and especially elevated objects and objects with vertical surfaces where rundown of other agents will provide only partial protection. The surface coating cuts off oxygen and is effective in preventing re-ignition.

To be effective the dry chemical has to retain its particulate form and should not cake or pack.

NFPA 17 standards recognize total flooding, local application and hose lines and pre-engineered Systems.

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The Singapore – whe

By Cpt Alvin Tan,
Chief Innovation Officer,
Singapore Civil Defence Force

INNOVATION has always been one of the main thrusts of the Singapore Civil Defence Force (SCDF). Apart from Work Improvement Teams (WITs) and the Staff Suggestion Scheme (SSS) practised throughout the Civil Service, there are also other initiatives unique to the SCDF – such as the *Learning Organization* (LO) and *Project Study Group* (PSG). These forums have helped to nurture and reinforce the creative spirit within the Force. To further promulgate innovation as an adventure expedition, the SCDF introduced the term '*Innoventure*' when it launched the *Innoventure Scheme* in 2001. Like the chrysalis of a caterpillar developing into a butterfly, the scheme marked SCDF's next phase of evolution in the innovation journey.

The *SCDF Innoventure Scheme* is essentially a framework to cultivate an innovative, creative and enterprising culture in the SCDF. It consists of two key aspects, namely, the *Innoventure Structure* and the *Innoventure Culture*. Briefly, the *Innoventure Structure* involves establishing a systematic network for an innovative organization while the *Innoventure Culture* represents the softer aspect of infusing creativity into SCDF's working culture to permeate every level of the Force.

SCDF Innoventure Structure

In setting up the *Innoventure* infrastructure, officers were appointed in all SCDF departments and ground units to help keep a constant lookout for creative expressions and ideas. These staff, known as *Innoventurers*, report directly to the SCDF Chief Innovation Officer (CIO), whose role is to nurture and develop the 'creative gems' unearthed by them – the long-term effect of which would help to institutionalise SCDF's *Innoventure Scheme*. In an active attempt to do away with these formalities, *Innoventurers* would, instead of having to go through the normal chain-of-command, report directly to the CIO immediately upon stumbling on any idea or suggestion. This effectively bypasses several administrative layers and champions a key premise that '*no idea is too small to be noticed.*'

Picture courtesy of the SCDF

And because the SCDF management recognises the importance of supporting the innovation drive, this has helped to pave the way for the expansion of role of the SCDF PS21 Main Committee to cover the approval of project proposals by the CIO. The Committee can also recommend select proposals to be jointly undertaken with other agencies; or to be submitted to higher levels such as the Home Affairs or TEC.

In order to provide financial support to deserving innovative projects and for low-risk experimentation, an *InnoventureFUND* was created as part of the

Civil Defence Force re innovation grows

Picture courtesy of the SCDF

Innoventure Structure. For low-risk experimentation purposes, funds are allocated to each unit whereby the amount sponsored for each trial project would be determined by the Unit Commander based on prescribed guidelines. If the project demonstrates success or potential, it can then be proposed for funding by the Force, or even at the Home Affairs and TEC levels, where the financial assistance is considerably greater.

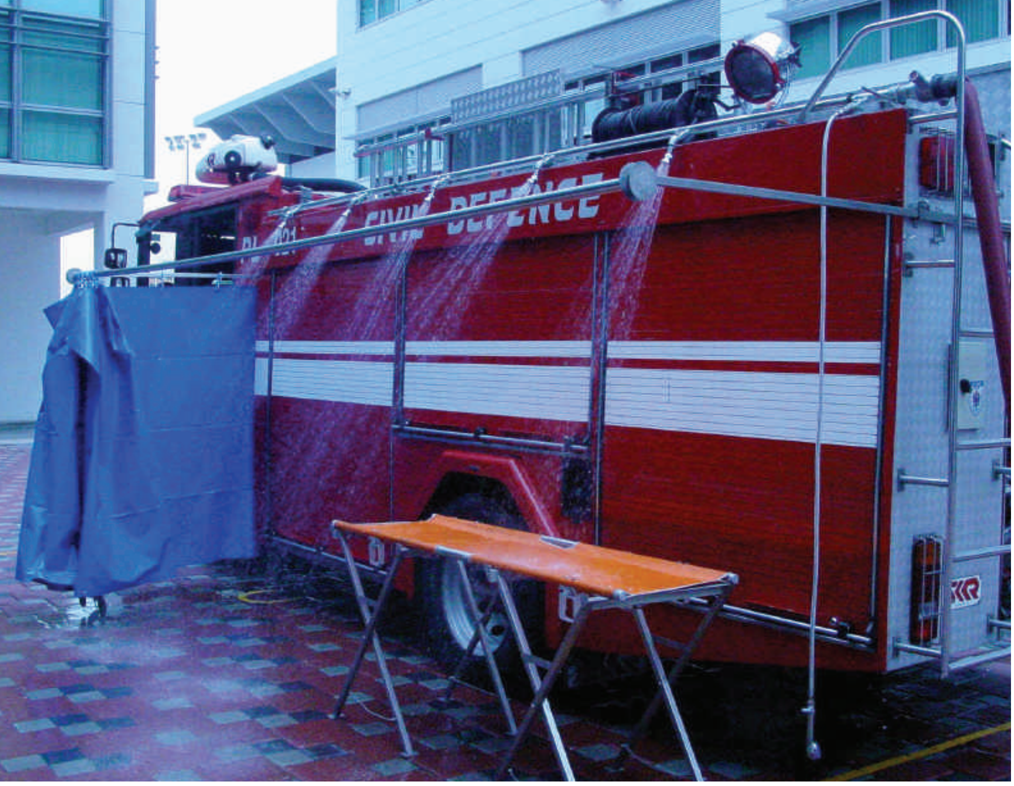
Outstanding projects that lead to the creation of internal or external customer solutions would be recognised through the *SCDF Innoventure Award Scheme* – a range of annual awards that recognises individual employees or teams for their innovations. It has long been acknowledged that when people are encouraged to develop their own solutions to problems and are duly recognised, the result is a powerful sense of empowerment that would elicit even greater participation from the employees. It is for this expressed reason that the *SCDF Innoventure Awards* also encompass awards for WITs and staff suggestions, not only to encourage staff contribution but also to inspire them to greater heights!

SCDF Innoventure Culture

The second aspect of the *Innoventure Scheme* is that of the *Innoventure Culture*, where the aim is to cultivate an SCDF that is creative in expression and innovative in thinking. Research has shown that ideas are often unleashed in an environment that is stimulating and unconventional. Hence, a major area in promoting an *Innoventure Culture* involved the setting of an SCDF innovation center – the *InnoventureLAND* – in May 2002 for staff to hold informal discussions that are conducive to the spirit of creativity and innovation.

At the *InnoventureLAND*, officers can find tools that promote creative thinking, posters describing new concepts as well as award winning projects

Picture courtesy of the SCDF



Picture courtesy of the SCDF

for others to learn and imitate. There is even a small workshop for those who are interested in product testing or prototype development! Coupled with the above is the *InnoventureSPACE* – a virtual environment that inspires ideas and cultivates learning by displaying some of the best WITs and SSS projects that have been completed.

Apart from such a showcase, the *InnoventureSPACE* also acts as a repository for research materials and video footages of previous innovations for other staff to refer to. All in all, even though the *Innoventure Scheme* has only been in place for little less two years, the SCDF has already witnessed several innovation projects that have come to fruition as a result of it.

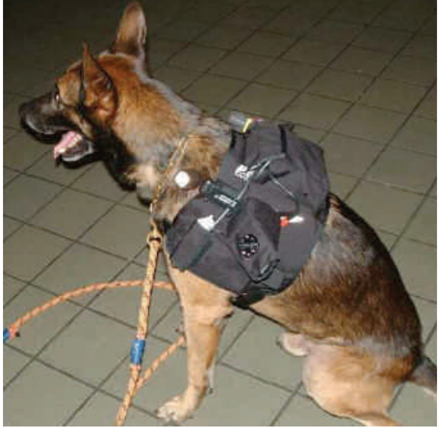
Picture courtesy of the SCDF

Fruits of the Innoventure Scheme

A prime example is the TEC-funded *WaterMist Gun (WMG 160)* project – an innovation that has since proven its efficiency at numerous fire incidents in Singapore. Completed in July 2002, the *WMG 160* works by atomising water into a fine spray of mist instead of shooting a jet of water, as conventional nozzles would do. In this way, it not only saves water, extinguishes household fires more quickly (by way of reducing the oxygen supply to the fire), but also helps to prevent water-damage and to conserve the property for fire investigation purposes.

At the Home Affairs level, winning SCDF innovations funded by the Ministry includes the *Canine Camera* and the *RECCE Camera*, just to name a few. The *Canine Cam*era shows inventiveness as it binds technology with man's best friend – in this case the SCDF Rescue Dog – to introduce a whole new way of conducting search and rescue operations. On the other hand, the *RECCE Camera* can be mounted on the cages of aerial appliances that are available at fire stations. Besides facilitating more accurate reconnaissance of the rapidly changing situation at the incident site, the project also allows Ground Commanders to deploy forces with greater effectiveness.

Last year, the SCDF also received the coveted Eureka Award from *Spring Singapore* for its revolutionary means of conducting hasty decontamination during incidents involving hazardous materials. It involves the retrofitting of conventional fire engines with decontamination facilities. Whereas it took eight men about 20 minutes to set up a decontamination unit at an incident site, recent modifications have been done to some 30 fire engines, such that it now requires just four men to set up similar facilities within three minutes. This was a project developed and funded under the *Innoventure Scheme*.



Picture courtesy of the SCDF

Apart from these completed projects, many other interesting proposals with potential are being studied. This includes unconventional methods of helping ambulance crews evacuate casualties from tall buildings so that the process is swift, safe and convenient.

Conclusion

Indeed, the introduction of the *Innoventure Scheme* by the SCDF has seen many successful projects become reality. More importantly, the *Scheme* will pave the way for creativity and innovation to become a way of life for successive generations of SCDF officers to come. There is another hope – that someday, there will no longer be any need for any *Innoventure Scheme* or its infrastructures. That will be the day when the zeal of the *Innoventurer* will reside in every officer, where their *InnoventureLAND* would be the ceaseless expanses of the their own creative minds. That would be the pinnacle of innovation's evolution, just as how the chrysalis of a caterpillar would slowly, but surely transform into a butterfly.

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Safety and Sec

Security technologies are set to draw immense worldwide attention

Many attendees from previous exhibition

The aftermath effects of the September 11 terrorist disaster and JI Movement are spurring governments, corporations and individuals in the Asia Pacific countries to pay greater attention to their total safety and security needs.

It is of no surprise then, that the consolidated presentation of Safety & Security Asia 2003 (SSA 2003), organised by the Commercial & Industrial Security Corporation (CISCO) and Conference and Exhibition Management Services Pte Ltd (CEMS), will take centre stage at the Singapore Expo from 8–10 October, 2003.

SSA 2003 aims to serve as a platform for showcasing the latest in safety and security technologies to address the growing concern for personnel identification and access, protection of properties and lives; as well as the safeguarding and recovery of vital information that is the lifeblood for businesses or organisations.

The exhibits at SSA 2003 will focus on futuristic X-ray machines for weapon detection, biometric and iris scanning for personnel recognition, data system protection and remote surveillance of premises and key installations, satellite telecommunications and control, and data protection and storage.

Mr Edward Liu, Managing Director of CEMS, highlighted the complete paralysis of corporations that were hit at the ill-fated World Trade Centre in New York during September 11, signifying the loss of billions of dollars of business data and records. The amount is equally daunting for the organisations to replace the systems and rebuild their lifeline from base zero.

"For SSA 2003, there will be renewed focus on the importance of information security including data storage, backup and disaster recovery in de-centralised locations, which is now becoming the key initiative by governments and multi-national corporations," added Mr Liu.

An article on the global security markets by Security World in their Jan/Feb 2002 issue highlighted that fear of crime and terrorism was one of the main reasons for continued strong demand for security. It was reported that "people are expressing a need for both safety and security where theft, vandalism and violence seem to be continually on the rise".

With this heightened consciousness, organisations and individuals today are also adopting new and sophisticated technologies to protect assets, lives and properties to counter multi-faceted security and safety threats. Despite the plunge in consumer and business confidence due to the worldwide economic slump, the safety and security industries have seen a surge in buying interests of its products and solutions.

The positioning of SSA 2003 as the region's definitive event for safety and security will no doubt be boosted by the cross-border efforts by governments in Asean, South and North Asia and the Oceania region in their fight against the terrorist threat. The show is expected to attract some 260 exhibitors from 25 countries and an increase in quality visitors to 6,500 across 40 countries.

In conjunction with the exhibition, a 2-day Safety & Security Asia Conference will take place on the 9 and 10 October to address the concerns and issues in the industry. The conference will be steered by a Technical Advisory Committee headed by CISCO and various security experts in the region.

In addition, the International Aviation Fire Protection Association (IAFPA) will be hosting their 4th presentation of the Aviation Fire Asia 2003 conference in Singapore which will further attract important airport and aviation fire protection and safety professionals to the same venue.

SSA 2003 will be the premium event for the leading security solutions developers and providers to come together to offer effective solutions in response to the market's sophisticated demand. It will be held concurrently with Build.Asia Pac 2003 and Glasstech Asia 2003, two of CEMS's building and construction platforms that draw visitor groups comprising architects, contractors, developers and engineers. The three exhibitions together are expecting to attract a combined 1,500 exhibitors and 20,000 trade visitors.

For editorial enquiries regarding Safety & Security Asia 2003, please contact Mr. Ang Kah Wah, Marcom Director at Tel: (65) 6278 8666, Fax: (65) 6278 4077 or Email: info@cemssvs.com.sg.

urity Asia 2003

Security Asia re-brands and takes a new name

Steering to be more electrifying then ever before

The immensely successful Security Asia 2001 received well over 6,000 trade and professional visitors from a vast 38 countries and the coming show can only get better.

Formerly held concurrently with Fire, Safety & Rescue Asia, Safety Security Asia has merged the fundamentals of both leading shows into one to give birth to **Safety & Security Asia (SSA) 2003**!

Live Fire Demonstrations

As fire safety is an inextricable part of total security, we have decided to expand the show's scope to include this aspect so as to offer a truly one-stop, convenient destination for security practitioners and decision-makers. This is to further strengthen the position of SSA as the region's most authoritative security and fire safety event. The latest reformation has already seen approximately **75 percent** of the total area of the allocated 3,000 sqm taken.

With increased safety and security consciousness over recent times due to the aftermath of Bali bombings and threats from the JI Movements, SSA expects to attract strong international exhibitor participation and promises to showcase an exciting variety of latest, state-of-the-art technologies and innovations.

Live Fire Demonstrations

Another noteworthy development is that the International Aviation Fire Protection Association is staging their Aviation Fire Asia Conference. Concurrent with SSA in the same venue. This synergy could see the possible participation of more fire related companies at the exhibition.

In terms of national pavilions, the British Security Industry Association has received strong interest from more than 30 companies to their mailing; and as such Mr Peter Nicolls expects to form a strong contingent from the UK. Other countries with groups forthcoming are Korea and South Africa.

The co-location of SSA 2003 with the Build.Asia Pac 2003 and Glasstech Asia 2003 events enable the 20,000 or so trade visitors to view a wider range of products under one roof.

Dedicated as a convenient, one-stop destination for keeping abreast of new security technologies, it also serves as a forum for highlighting global trends and issues to enable security professionals to update their knowledge. This will in turn enable them to be alert and incisive in managing potential threats and risks in the environment.

The return of the 2nd Merlion Awards, competition will continue to give progressive companies a platform to recognise their product innovation excellence in the ASEAN region and beyond. Entries are categorised under two areas, ASEAN and OPEN, with a maximum of three winners for each group.

To top it all off, the SSA 2003 Conference is back to cater to the ever-growing needs of security professionals and decision-makers alike. With a whole range of topics to speak on, we invite you to come and make a difference and benefit while sharing your expert knowledge in the betterment of our society.

With the numerous on-going activities, the Safety & Security Asia 2003 can only foresee brighter prospects.

Contact Conference & Exhibition Management Services Pte Ltd at Tel: (65) 6278 8666, Fax: (65) 6278 4077 or Email: info@cemssvs.com.sg.

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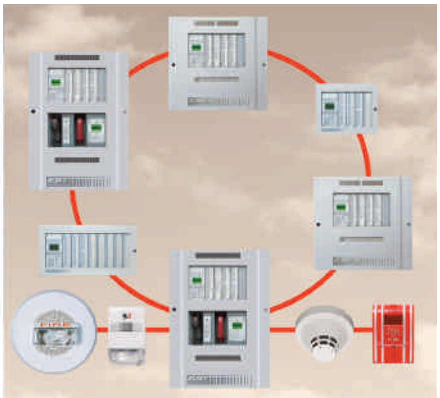

EST3 has both the power and the capacity to handle even the largest installations. Supporting Signature Series multisensor analog detectors on a multi-priority peer-to-peer token ring network, EST3 boasts exceptional alarm response and virtually fail-safe operation.

An ideal solution for high-rise office towers and campus style installations, the EST3 supports a total network length of an incredible 60 miles and it does this without sacrificing even a nanosecond from its lightning fast three-second response time.

EST3’s user interface offers simple yet powerful control and display in any situation. Fingertip operation and intuitive feedback provide the big picture whether the user is in the midst of a crisis, or simply performing routine maintenance. And because EST3 supports a full eight channels of multiplexed audio, there’s plenty of capacity to handle communications. Firefighters, emergency response personnel, and building occupants can all keep in touch when seconds count and information can save lives.

But its modular design is what makes EST3 a favourite with building owners, installers, and property managers: system components are arranged in layers that swing out for easy access; key components feature removable terminal blocks and simple plug-in connectors; and, its modular design means the system can easily keep pace with even the most radical changes to building floor plans.

Extremely flexible, easy to maintain, and a breeze to service, the EST3 is brimming with design innovations geared expressly towards the goal of providing exceptional performance with a minimum of system overhead.

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Signature Series detectors offer true multisensor technology and exquisite reliability that virtually does away with false alarms. They accomplish this by means of an on-board microprocessor that constantly monitors the state of its sensors. Using a sophisticated algorithm, the microprocessor effectively distinguishes between a legitimate change of state and a non-threatening situation that would otherwise lead to a false alarm.

What’s more, true multisensor technology means that a single device can perform optimally under a wider range of conditions than any single-sensor detector.

Photoelectric and ion detectors see smoke, but not all fires produce it. Heat detectors, on the other hand, spot temperature changes, but these aren’t always an indicator of a life-threatening event. Multisensor devices, however, collect data on several different environmental parameters at the same time, and then weigh the results to determine whether an alarm should be sent to the control panel.

Multisensor or not, all Signature detectors feature analog technology. This allows them to gather information continuously, concerning the state of their sensors and track the results over time. As detectors become dirty, the on-board microprocessor makes minute adjustments to the alarm threshold, thus avoiding false alarms. And when the threshold approaches the point where the device sensitivity could become compromised, the detector automatically sends a message to the control panel indicating that it’s time for a cleaning. This means that detectors are always at their peak level of performance.

All Signature Series devices make full use of their on-board microprocessors. Alarm decisions are made at the device, thus reserving precious processing power at the control panel for other functions. This strategy, known as Distributed Intelligence, means that high communication speeds are unnecessary because the data reaches the control panel already processed. And lower communications speeds means that shielded wiring is unnecessary: Signature Series devices can use existing wiring in most retrofit applications, yet at the same time deliver response times superior to conventional devices!

Dip switches and dials are also a thing of the past where Signature devices are installed. Because they are electronically addressed, the Signature loop controller automatically maps each device’s location. And that means the system always knows what’s out there and device-polling resumes automatically at power up, regardless of the changes that have taken place.

Change is, after all, what detectors are all about. The trick is choosing the right one for the job. True multisensor technology means that a single device can perform optimally under a wider range of conditions than any singe-sensor detector.

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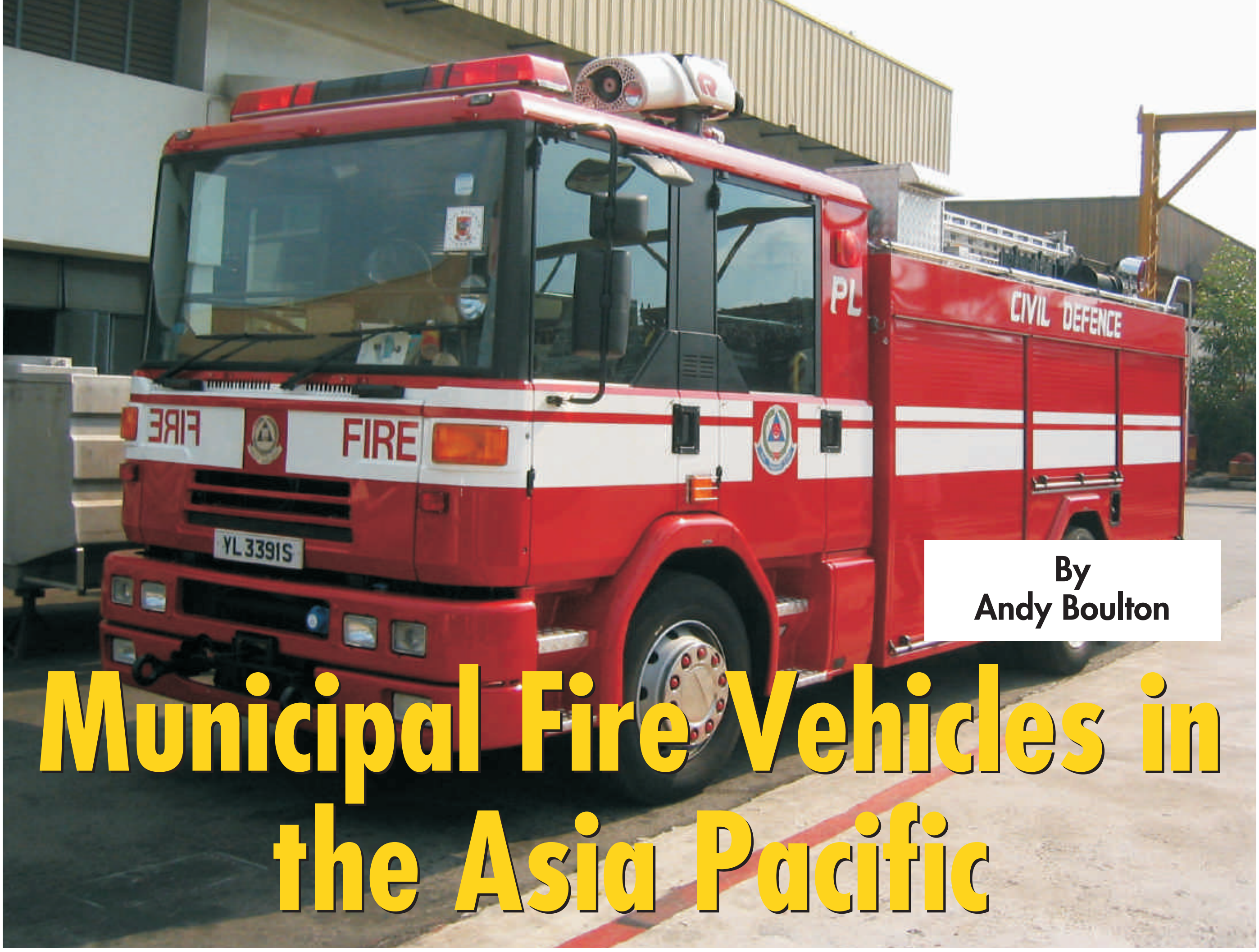

Municipal Fire Vehicles in the Asia Pacific

By
Andy Boulton

A Singapore Civil Defence Force Sabre Heavy Pump, Dennis Sabre

THE CHIEF ENGINEER of all fire services around the globe are today faced with similar issues concerning provision of vehicles to support fire fighting and rescue operations within their jurisdictions. This is having to be done under ever tighter budgetary constraints and so the appliances which are now specified are more carefully selected to maximise their flexibility and use in the local territories.

The fundamental force behind any fire fighting operations is the Pump. This device has come a very long way since first the labour intensive hand operated device of the 19th century through the horse drawn reciprocating steam pumps of the early twentieth century through to the motorised centrifugal pumps which are still in use today.

In terms of pumps today, we think not of just the pump itself but the vehicle around it, which is the backbone of current fire and rescue operations throughout the world. The specification of the Pumps in service today in Hong Kong, Singapore and other major cities are based on the UK's JCDD (Joint Committee for Design and Development) class B pump specification although in recent times, this is being complimented by the European EN 1846 specifications which is impacting the UK and European appliances. The JCDD requirements are very stringent and include vehicle performance criteria such as braking and acceleration, which are in excess of those for normal on road truck operation as well as fire fighting equipment performance.

Positioning of the pump within the appliance has been split along regional grounds. European based appliances are traditionally positioned at the rear and American based appliance mounted amidships behind the cab. The mid mounted pump may be operated from either side of the appliance but occupies more space within the vehicle leaving less space for equipment. The rear mounted pump can potentially leave the operator exposed to injury when operated on highways. Owing to space constraints in the vehicles appliances in Hong Kong, Singapore and Tokyo for example have rear-mounted pumps and locations such as Australia and New Zealand have mid mounted ones.

The Class B pumps or Major Pumps, as they are described by the Hong Kong Fire Service, attend all fire calls and comprises of around 40% of the fleet. The latest generation vehicles are state of the art purpose designed and built Dennis Sabre chassis, which have a GVW (Gross Vehicle Weight) of 14.5 Tonnes. With the Cummins ISCe Euro 3 engine rated at 260 bhp, coupled through the Alison World Series gearbox with integral retarders, they have a very good power to weight ratio to ensure acceleration which is critical in the very busy traffic conditions of the city streets. Stainless steel cabs and corrosion resistant bodies are specified to ensure longevity. The cabs have to comply with part A, B&C of ECE20, which ensures safety to the crew through front impact and crush protection.

A pair of Euro 3 Dennis Sabres on delivery into Hong Kong

> *Health and safety legislation in the UK has seen the disappearance of the roof access ladders on the rear of the appliances but they remain in Hong Kong giving the appearance of a traditional UK appliance.*

Health and safety legislation in the UK has seen the disappearance of the roof access ladders on the rear of the appliances but they remain in Hong Kong giving the appearance of a traditional UK appliance. The latest automatic gantries allow easy access to the roof mounted ladders, which is further made easier by the vehicle's air suspension having the facility of being 'knelt'. The latest styles of modular locker designs are now available and being introduced which allow equipment to be slid out and down and then removed on removable trays which means the fire-fighter is no longer having to lift heavy equipment in difficult and uncomfortable positions.

As the number of calls to the fire service involve Special Services calls or not fire related, the first response by the pump in Hong Kong is complimented with a Light Rescue Unit. These vehicles are based on a Mercedes van chassis with crew cab and a fire appliance body. These units carry a crew of 6, the same as a pump, and can thread their way through traffic more efficiently thus delivering more personnel to the fire-ground whilst also carrying rescue equipment for immediate deployment.

A number of well publicised severe fires in Hong Kong in the 60s in urban areas was the catalyst for the development of the combined Hydraulic Platform and Pump. The traditional pump was unable to get close to the source of the fire whereas the hydraulic platform with its water tower capability was able to attack the fire from above and also give command and control advantages to the officers in charge resulting in a safer fire-ground.

This policy continues to this day with a combined pump/hydraulic platform being dispatched as part of the first response to all fire calls. This policy allows for faster rescue from high levels whilst maintaining pumping capacity, which saves on both manpower and equipment. The vehicle, which is currently in service, is based on the Scania P94 chassis with the Series 4 safety cab with a 50-foot Magirus Simon hydraulic platform. These vehicles carry the same pumping capacity of the major pumps, which is typically 4000 litres per minute at 10 bars.

The Aerial Appliances, which are used in Hong Kong, are constrained as they have to comply with the local road transport regulations which only allow 30 tons on 4 axles. As such the latest vehicles to be purchased are the 52m Bronto Skylift, which is based on a Scania 4 axle chassis. Such a vehicle is ideally suited to the operation with a combined ladder and hydraulic platform operating to a maximum height of 52m yet operating with a relatively small footprint to allow manoeuvrability and retain the ability to deploy in the tight street environment. Such machines somewhat dwarf the traditionally sized 32m vehicles, which are employed by the UK fire brigades. In additional to this, Hong kong operate a number of turntable ladders at the same height.

Speed of response is also most important and both Hong Kong and Singapore have fire motorcycles in operation. The BMW R110 RT is used by the Hong Kong fire service and this carries a compressed air powered high-pressure water system for extinguishing smaller automobile related fires. The Singapore version in addition to this carries breathing apparatus for the fire fighter. The motorcycle is able to offer a very rapid response where traditional appliances would struggle to get to a

A Fort Bonaficio, Manilla Pump Ladder, Dennis Sabre

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A Hong Kong Fire Services Hydraulic Platform/Pump, Dennis RS

traffic related incident or fire. This is especially the case in Hong Kong where the heavily congested roads can become quickly gridlocked by the most minor of traffic related incidents.

Successful fire fighting is dependent on having a reliable water supply and where this cannot be guaranteed then water must be carried to the fire fighting operation. Whereas in some Asian cities such as Manilla, hydrant water supplies are so unreliable that a water tanker is included in the first response, in areas where this is not so, it makes more economic sense to invest in a larger pumping appliance with additional water carrying capacity than the standard 1,800 litres. For fire fighting in areas where there are poor water supplies or remote access, Hong Kong have purchased heavy pumping units which have a GVW of up to 18 tons which allow the carrying of up to 3,000 ltrs of water. This allows for both normal operation and water relaying in one vehicle. They have selected the Scania 124G chassis to fulfil this function.

Singapore Civil defence force use a similarly specified vehicle, the Dennis Sabre HD (Heavy Duty) to fulfil a similar role although Singapore has a different philosophy for response to fire calls as the water supply is very robust and the structures, which tend to be more modern, are fitted with built in fire services such as dry risers and sprinklers.

To compliment these heavy pumps, Singapore Civil Defence Force have commissioned their own unique design of fire vehicle for Singapore from Delgro Engineering. Based on the Bucher Duro 4x4 chassis, the Light Fire Attack Vehicle (LFAV) is a small compact open topped appliance, which carries minimal equipment and no water yet is fitted with a 1100 ltr/min pump and monitor. It is designed to allow a rapid first response to fires in areas accessible to mains water. It's light, compact size and all terrain capabilities allows it to travel closer to the fire and allow rapid deployment of fire fighters and connection of a water supply to the dry riser of the building.

As vehicle design and technology progresses, in particular engines, transmissions axles and tyres, there is now the ability to give similar payloads and pumping capacities on reduced or 'compact' sized appliances. Typically these would be just under 2.3m wide as opposed to the full sized appliances, which are 2.4m. They would be also shorter than their full sized counterparts. These are of benefit for the more rural or difficult to access locations such as well as the tight city streets. Cities such as Tokyo are already using similar sized pumping appliances based on the Mitsubishi, Hino and Isuzu chassis.

Such appliances are being able to be manufactured as smaller engines are being introduced into the markets, which can develop very high outputs for example a Cummins 5.9l ISCe fitted in the Dennis Dagger appliance can operate now at 275 bhp. New tyre designs, which are able to take higher loads with smaller sizes, are able to reduce the heights of the vehicles and therefore the access and egress is made easier for the fire fighter in protective clothing.

Owing to the growing concern over atmospheric pollution caused by diesel emissions in the city environment, fire appliances do not escape the regulations and new vehicles have to comply to the latest Euro 3 emissions regulations, United States EPA or Japanese regulations. In addition to this, there is pressure to fit downstream exhaust treatments which are also now available for fitment such as CRT (Continual Regenerating Traps) which removes particulates from the exhaust stream.

All this technology however comes at a price, and with the ever increasing scrutiny on public sector budgets especially when economies are operating in deflationary times, this all puts pressure on the fire service engineer and officers when making procurement decisions. It is the job of the suppliers to balance the incorporation of such technologies with practicalities whilst designing a cost effective multi-purpose fire-fighting appliance.

> *Successful fire fighting is dependent on having a reliable water supply and where this cannot be guaranteed then water must be carried to the fire fighting operation.*

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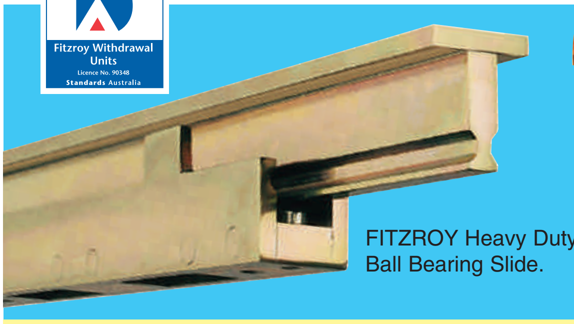

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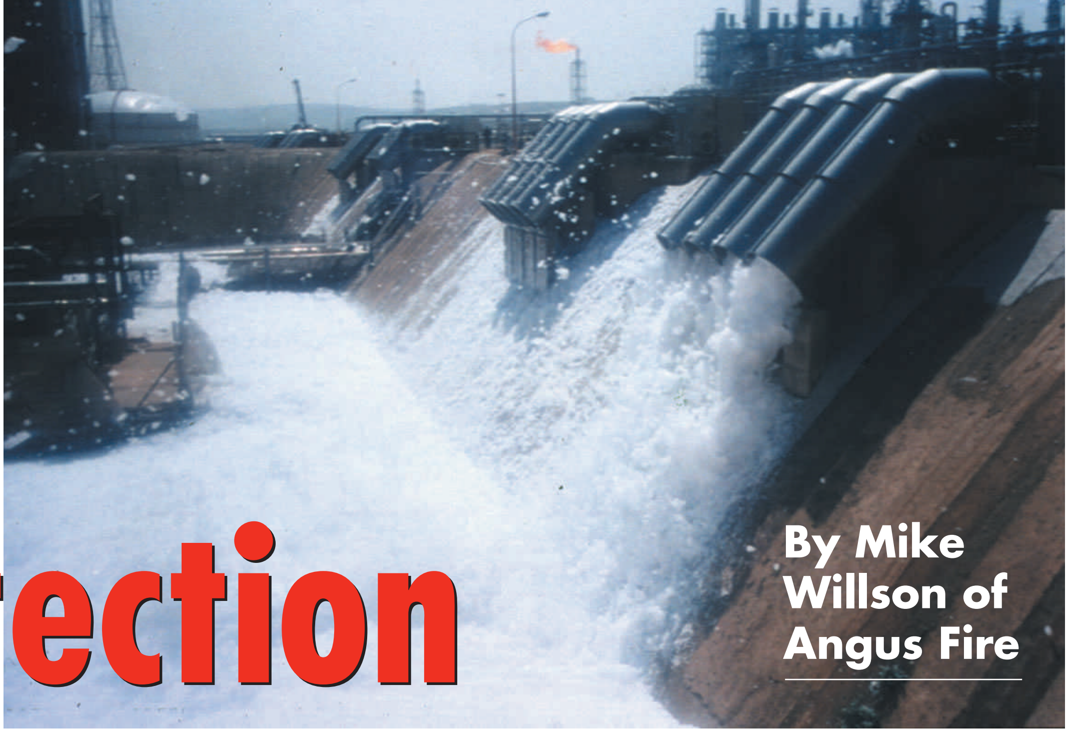
LNG Fire Protection

By Mike Willson of Angus Fire



Angus Fire LNG Fixed Turbex Systems providing rapid protection for LNG storage tanks at Sonatrach in Algeria, the world's largest exporter of LNG.

LIQUIFIED NATURAL GAS (LNG) and **LIQUIFIED PETROLEUM GAS (LPG)** vapour forms a highly flammable mixture with air, and so an accidental spillage in the bunded (diked) region around a bulk storage tank poses a severe cryogenic fire hazard. The most widely accepted means of controlling such hazards is by using high expansion foam.

Such cryogenic liquids are in fact gases at normal ambient temperature and pressure, but are stored at very low temperatures, for LNG around –164°C, to reduce them into their liquid, rather than gaseous state. Clearly this makes processing, storage and transportation for distribution easier and more cost-effective.

THE HAZARD

LNG is 83–99% Methane which if ignited generates vast quantities of heat radiation very quickly (93,000kcal/m^3/hr), typically twice the heat produced by an equivalent quantity of gasolene/petrol. However, unlike petrol the volume increase of LNG gas from its liquid phase is around 600 fold.

Consequently, any accidental leakage of LNG boils instantly, gaining heat from its surrounding environment, the ground, concrete, pipe work and even the air into which it is rapidly evaporating. Initially the gas is heavier than air, but as more heat is absorbed with time, it gets closer to ambient temperature making the gas lighter than air. In this 'lighter-than-air' state the evaporating gas is carried away by the air currents and wind, and will ignite at very low concentrations in air (typically 5–15% by volume). It is therefore the edges of the gas cloud that are most likely to find an ignition source causing a risk of explosion and rapid burn back towards the evaporating liquid pool. Clearly the plant and its surroundings will be seriously damaged by the radiant heat flux, unless proper provision is made to protect against such spill hazards.

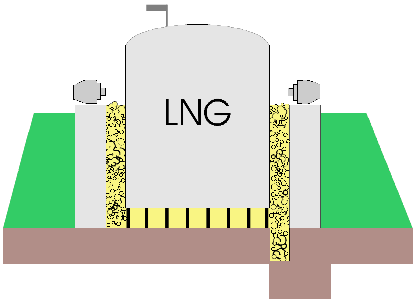
Liquified Petroleum Gases (LPG), comprising Propane and Butane, have a higher boiling point than LNG. Propane has a boiling point of –42.5°C (at 1Atm) whilst Butane is around 0.5°C so it does not boil off to a gas as quickly as LNG. In their gaseous state LPG's are always heavier than air so sink to ground level. Once evaporated the gas has a tendency to flow downhill and occupy hollows, basements, underground tunnels etc. They produce similar levels of heat radiation to LNG when ignition occurs. The flammable range of LPG is typically 2–9% by volume, so again it is the edges of the gas cloud along the ground, where fire will start. This could be several hundred metres from the leak source.

WHAT IS ADEQUATE PROTECTION?

There are two aspects to controlling such an LNG or LPG spillage.

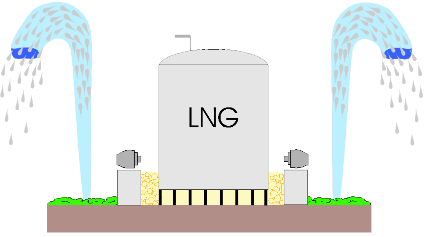
Passive Protection

Firstly the design of storage tank and its associated bunded or diked area to contain the spill is an important means of passive protection. A high bund wall serves to contain the LNG spill and disperse the vapour safely to high level. Sub-dividing the bund with low walls or sloping sides to a deeper trough will also help to minimise the surface area for evaporation of the LNG.



When the bund wall is low additional water curtain systems may be required to reduce the radiant heat flux to surrounding tanks and associated plant.

Tanks may be partially buried, often called 'in-ground tanks', with low bund walls to permit the production of high expansion foam onto the roof to minimise radiation effects. Water spray systems may also be installed to further



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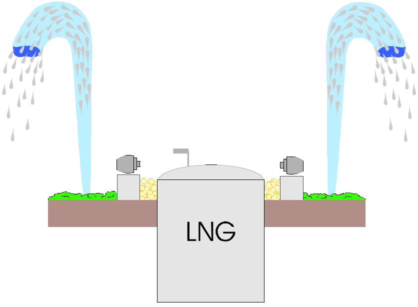
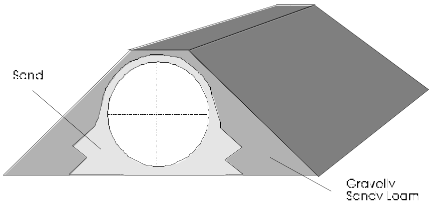
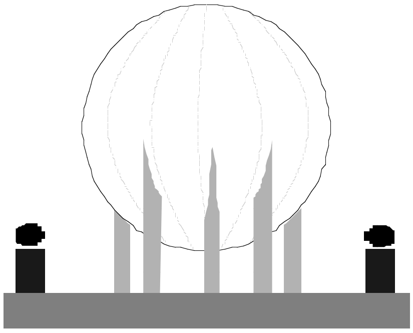


minimise radiated heat flux to adjacent structures.

LPG on the other hand is predominantly stored in steel vessels called spheres or bullets either above ground or increasingly earth mounded.



Similar passive bunding may be used to contain any spillage but the primary protection uses water spray systems to actively cool the vessels and retain their integrity reducing the risk of a BLEVE (boiling liquid expanding vapour explosion). Literally burying the tanks under mounds of earth reduces this risk further, keeps sunlight off the tanks and offers cosmetic benefits.



Active Protection

At the outset any active fire protection system for LNG must be designed for one of two scenarios – either vapour dispersion or fire control.

Vapour Dispersion

A high expansion foam system is chosen for vapour dispersion, to reduce the danger of an unignited LNG spillage by assisting effective upward dispersion of the vapours that are boiling off. This reduces vapour concentration levels at ground level where there is greatest risk of potential ignition. One must accept that if ignition does subsequently occur this dispersion system may be insufficient to provide fire control.

Fire Control

For fire control, a high expansion foam system is chosen to control the fire if ignition of the LNG spillage occurs, preventing catastrophic failure. This is achieved by means of a controlled burn off through the high expansion foam blanket that will also reduce the radiated heat flux to surrounding plant.

Clearly making the right choice here is crucial. Overall system cost for each of these two applications may well be a significant factor in this decision, since each system will need to have very different application rates, operating times and quantities of protecting equipment.

However, for LPG the vapours cannot be warmed by foam since they are always heavier than air, so fire control in the bunded area is the only situation where foam would be used.

The first requirement for any scenario is a suitable detection system, which must be capable of immediately identifying any spillage that has occurred. This should be linked to a suitably rapid method of warning all site personnel and emergency services of the spillage hazard. This detection system must also establish whether the spillage has ignited.

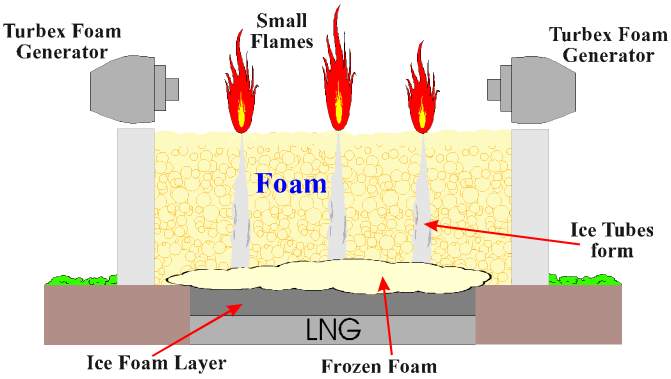
Time to initiate actuation of the fire protection system is a critical factor in all scenarios, whether for LNG fire control, LNG vapour dispersion or LPG fire control.

STANDARDS

International standards like the American National Fire Protection Association NFPA 11A:1994 and British Standard Institute BS5306 Section 6.2:1989 both recommend high expansion foam systems for the protection of LNG hazard areas but draw a cautionary note on LPG not to extinguish, since extinguishment by foam may occur. This would result in the evolution of heavier-than-air vapours draining off from below the foam blanket and danger of a vapour cloud building up, or re-ignition or both. Recognising the complexity of this cryogenic hazard, neither standard provides any specific application rates (a measure of how much foam is being applied to the hazard area each minute) or discharge times. NFPA 11A:1994 suggests that application rates should be established by tests, so that a positive and progressive reduction in radiation is achieved within the time limitations established in the analysis. This should be increased by the necessary factor to account for the initial vaporisation rate and the configuration of the hazard. The determination of the system design shall depend on an analysis specific to the individual site, since time to initiate actuation is a crucial factor in fire control. The analysis shall consider effects of heat exposure on adjacent plant equipment.

TEST DATA

Over the years extensive test work has been carried out to prove the effectiveness of high expansion foam for LNG vapour dispersion and LNG fire control, but limited test work on LPG. The majority of these tests have shown that foam of expansion ratio 500:1 (large bubbles produced by adding 500 parts of air to each part of foam solution), appears to be superior to both higher and lower expansion ratios for vapour dispersion as well as fire control purposes. Accordingly the vast majority (over 100) of operators for LNG liquefaction facilities, peak shaving plants and LNG import terminals around the world are using high expansion foam systems of 500:1 expansion ratio. Some tests have used foam of expansion between 150–300:1 for fire control, which has shown an increased penetration range into the fire. However, foam solution consumption rates can increase adding cost and it may be slower to flow across the spillage. Having said this 300:1 is a more popular expansion ratio for the fire control of LPG, which is not stored at such low temperatures.



The application rates used in these high expansion foam tests vary dramatically and produce widely varying reductions in fire intensity, varying speeds for a reduction in heat flux to occur,

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LNG bulk storage tanks protected by specialised water-driven turbine high expansion foam generator systems.

and varying effectiveness of the foam blanket to maintain control over time.

Consequently the rates may vary significantly from one manufacturers foam concentrate and foam generating equipment to another, since a wide range of factors will affect the foams performance.

Factors affecting the overall effectiveness of any high expansion foam system are complex and interrelated. They include the:

- Size of LNG or LPG spillage
- Application rate
- Expansion ratio
- Foam concentrate (formulations vary and can produce widely varying performances)
- Foam induction rate (accurate proportioning is crucial to consistent foam production)
- Foam generator (different technologies will produce widely varying foam quantities)
- Foam bubble stability (size, uniformity and ability to retain water)
- Depth of foam blanket
- Speed of system operation
- Prevailing weather conditions

Factors of safety should also be taken into account by the fire protection system designer or ‘Authority having jurisdiction’ over the specific installation. Extreme care should therefore be taken when choosing the most suitable high expansion foam system for these complex applications.

HOW DOES THE FOAM WORK?

Fire Control

The gas produced by vaporising LNG under accidental release conditions is at a temperature close to that of the LNG itself (–164°C). Vapours boiling-off are heavier than air and form a cold vapour cloud hanging above the spillage. Unless immediate action is taken, air movements will begin spreading this cloud horizontally in all directions from the spill until it is sufficiently diluted with air to become flammable. Then, somewhere at the edge, where the LNG vapour is well mixed with air, forming a 5–14% gas concentration, it will find a source of ignition, ignite and burn back to the liquid pool.

If the LNG vapours do ignite, a major problem exists in addition to the vapour cloud – that of severe radiated heat. The degree of severity depends on how far away the fire is from surrounding buildings, plant and personnel on site, as well as the prevailing environmental conditions at this time. However, buildings a considerable distance from the fire will be at risk, even during still air conditions and any wind will dramatically increase the radiated heat in the downwind direction, so protective action must be taken.

The mechanism for fire control using high expansion foam is quite complex. Essentially a foam blanket is rapidly produced to reduce the rate of heat transfer from the fire to the liquid LNG pool, slowing the initial boil off rate down to a steady state situation.

Expansion ratios of 500:1 (when produced from a high quality foam concentrate) appear to be optimum for minimising the time required to gain control of an LNG spill fire.

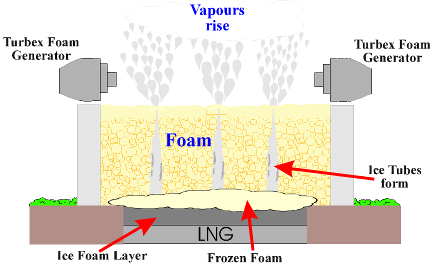
Despite the intense radiant heat from the burning LNG pool, the 500:1 foam blanket quickly freezes at the foam-LNG interface, but this ice layer is light enough to float upon the LNG surface and also strong enough to support several feet of foam build up, without breaking or sinking. Near this interface ice tubes also begin forming where the escaping cryogenic vapours are boiling through the foam blanket. Rapid foam application dramatically reduces radiation flux levels, until the flames burn back the foam bubbles, when further foam is applied. Ongoing fire control is achieved by periods of topping-up after each burn back. Repeated applications of foam are continued until the LNG pool has completely boiled away, vapour levels return to normal and the incident can be declared over.

High expansion foam has a similar effect on LPG adding heat and increasing the rate of vaporisation. 70% heat flux reductions can be achieved by controlled burn off. Moisture, air and flammable vapours premix in the foam blanket causing increased combustion efficiency thereby producing a cleaner flame of shorter length. To achieve this the foam used should have a quarter drainage time in excess of 15 minutes for optimum stability. As with LNG, foam at the interface forms a low density frozen crust on the surface of the liquid. However, it is particularly important with LPG to avoid total extinction, otherwise the heavier-than-air vapour will flow outwards under the foam blanket and build up as a vapour cloud in hollows or basements with a risk of toxicity to personnel, sudden reignition or explosion.

Water spray systems located around the risk area may assist with the turbulent dispersal of the heavier than air vapours by mixing with air and diluting the gas cloud to below flammable levels.

Increasingly LNG operators are also opting to maintain fire control with foam rather than completely extinguish the fire with dry chemical powder. This avoids the risk of flammable vapour levels drifting or accumulating downwind then reigniting, causing increased danger to personnel and plant alike.

When a high degree of exposure protection is required for controlling large LNG spill fires, these high expansion foam systems can offer major cost savings over conventional water spray exposure protection systems. Such water curtain systems are far less efficient at



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reducing radiation heat flux than results obtained with high expansion foam systems, even though considerably higher water flow rates and supply pressures need to be used. This is especially significant on a first installed cost basis, since greatly reduced water flow rates and pumping capacities are required by high expansion foam systems. Operating costs would be higher for foam systems, but their anticipated usage should be severely limited and their effectiveness would be superior if needed!

> *High expansion foam will not disperse vapours of LPG, as they are always heavier than air. Controlled ignition of LPG vapours under a high expansion foam blanket (300–500:1) represents an effective way to burn off the LPG under controlled conditions.*

Vapour Dispersion

Not all accidental spillages of LNG ignite in the early stages of release. Some operators recognise that the configuration of their particular plant would mean a catastrophic failure if ignition took place, with the complete destruction of the facility however quickly action was taken. In these instances high expansion foam systems can also be highly effective in dispersing the LNG vapours upwards and away from the potential ignition sources.

It is to minimise the risk of vapour ignition that such systems are required to take immediate action by covering the bunded areas around these LNG storage tanks with foam bubbles of uniform 500:1 expansion ratio.

This foam covers the surface of the cryogenic liquid providing sufficient water content to warm the LNG vapours as they rise through the foam layer. This buoyancy effect will reduce the downwind travel of flammable concentrations near ground level and assist dispersion of the LNG vapours to higher and safer levels in the atmosphere.

High expansion foam will not disperse vapours of LPG, as they are always heavier than air. Controlled ignition of LPG vapours under a high expansion foam blanket (300–500:1) represents an effective way to burn off the LPG under controlled conditions.

LATEST DEVELOPMENTS

Angus Fire are recognised as world leaders in LNG/LPG protection. Their specialised Fixed Turbex high expansion foam systems are specifically designed for these cryogenic applications using Expandol foam concentrate which are in use at many LNG and LPG facilities around the world including Australia, Indonesia, Algeria, Qatar, UK etc. Amongst the largest has been a £3 million upgrade contract for the supply of high performance LNG Fixed Turbex Systems to Algeria's state owned oil and gas company Sonatrach. Probably the world's leading exporter of LNG, Sonatrach installed this system as part of the modernisation and expansion programme at its liquefaction plants in Arzew/Bethioua. The system fully complies with both NFPA 11A and the detailed technical specification issued by the M W Kellogg Company of Houston, Texas, who were the chosen engineering contractor appointed by Sonatrach to upgrade their facilities.

For a high expansion foam system to be effective the 500:1 generators must be located at the edge of the bund (dike) wall or edge of the containment/pump pit, so that any LNG spillage can be quickly covered with foam. Such generators cannot be located remotely from the bund because of the potential foam transit time delay. This could reduce the effective lifetime of the foam on the LNG spillage, and encourage water draining from the foam to enter the LNG pool and cause increased boil-off rates. A similar situation arises for LPG although a new 300:1 LPG Fixed Turbex has been developed specifically to meet this differing requirement.

Even if the LNG spill has not ignited, the risk of ignition is ever present. The severe radiant heat rapidly generated if ignition takes place, means that standard industrial high expansion foam generators are totally unacceptable for these specialised cryogenic applications. Standard industrial units usually include mild steel, aluminium or plastic based components which deform or melt with the radiant heat levels experienced, preventing effective operation and foam production.

Experience has shown that simple air-aspirating or 'spray on net' generators are easily starved of air by light wind movements and up draught effects blowing across the inlet, significantly changing the amount of air being drawn into the unit from one minute to the next. This variability on airflow when the foam solution flow is constant can have a major impact on the expansion ratio of the foam bubble blanket, producing very variable and far less efficient foam.

To overcome these inherent problems forced air technology is required using a

Sonatrach the world's largest exporter of LNG with storage tanks protected by Angus Fire LNG Fixed Turbex High Expansion Systems at their Arzew complex in Algeria.

Pic courtesy of MW Kellogg Company

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Angus Fire LNG Fixed Turbex units protecting LNG containment kit at PT Badak's huge Bontang facility in Indonesia.

water driven turbine and special aerofoil fan to provide a consistent airflow through the LNG high expansion foam generators to maintain expansion ratio, without resorting to any electrical power source which could also cause ignition of the vapour. This minimises the bad effects of wind and up draughts. The revolutionary cocoon-shaped design of the Fixed Turbex ensures a stable slow-draining foam blanket and uniform bubble size for optimal performance, resulting in a far more reliable, efficient and uniform foam expansion, a major benefit over the simpler air aspirating units.

Clearly to withstand the potential radiation heat flux of an LNG spill igniting, special considerations must be made in designing and producing a suitable turbex foam generator. The onerous fire exposure test requirement laid down in NFPA 11A must be passed by any generator for LNG applications. This requires exposure to direct flame impingement for 5 minutes over burning n-Heptane and the generator must then work satisfactorily. This fire intensity is designed to mimic the high radiation levels generated by LNG. During the development of the latest LNG Fixed Turbex Generators, special attention was given to these factors by Angus Fire. As a result a significantly upgraded 316 stainless steel and gunmetal high performance 500:1 unit passed this NFPA 11A fire exposure test by withstanding internal temperatures of 1000°C before then operating perfectly. The LPG 300:1 unit has been designed to withstand the same onerous conditions.

Clearly a fast acting foam proportioning system is also needed to mix Expandol foam concentrate into the water supply which can often mean a complex system of foam skids and remote induction, also designed and manufactured by Angus Fire.

WHICH FOAM?

The choice of foam concentrate is also an important factor in optimising foam stability and expansion ratio, to gain maximum effectiveness, whether for LNG/LPG fire control or LNG vapour dispersion systems. Lower quality concentrates usually exhibit less stability as indicated by their relatively faster drainage times (the time taken for 25% of the water contained within a known weight of foam bubbles to drain out). When the foam is more fluid with less uniform bubble production, its effectiveness at fire control and reducing vapour concentrations above the foam blanket are significantly impaired. Increased frequency of 'topping up' will also be required.

Many companies manufacture high expansion foams but the high quality concentrates like Expandol, exhibit greater stability, and when produced with a uniform bubble size maintain a significantly more stable foam layer. The vapours are therefore warmed and dispersed more efficiently by this higher quality foam and Fixed Turbex generating system. Such foam stability helps to reduce the required foam top up rate to a minimum, thereby maintaining effective control of fire or vapour dispersion with minimal foam concentrate usage. This can also help reduce the rate of ice build up at the LNG/LPG interface.

> *The onerous fire exposure test requirement laid down in NFPA 11A must be passed by any generator for LNG applications. This requires exposure to direct flame impingement for 5 minutes over burning n-Heptane and the generator must then work satisfactorily.*

CONCLUSIONS

This is a complex and quickly changing hazard to protect, with the ever-present risk of a major explosion.

High expansion foam systems are the most credible and preferred solution to reducing the fire intensity with LNG/LPG hazards and the vapour dispersion risks associated with LNG. Knowledge and test work in this area is limited, further work is hampered by the extremely hazardous nature of both LNG and LPG, the obvious reluctance from a safety standpoint in carrying out test work and the costs involved in monitoring any test spillages.

In addition to (and partly because of) these factors the amount of LPG and LNG expertise around the world is concentrated within a few organisations who have made a substantial commitment to understanding these problems and investigating ways to overcome them with effective solutions. Angus Fire and MW Kellogg are leaders who are pleased to be involved at the forefront of this specialised fire fighting technology.

A TRUE CUSTOM MADE FIRE VEHICLE

LFAV – Light Fire Attack Vehicle

From DelGro Engineering Pte. Ltd. Singapore

During emergencies, one of the crucial determinants for response is the time taken to reach the incident sites. With today's changing operating environment, the large conventional fire vehicles/chassis has in certain instances posed accessibility problem in the operations.

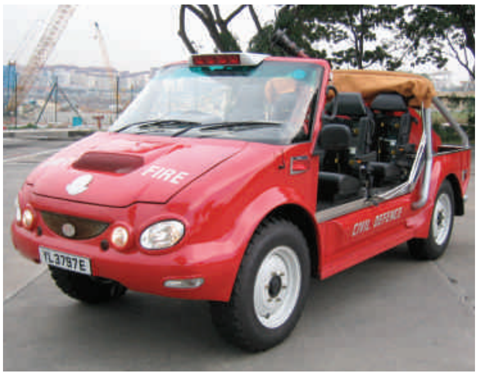
To overcome the problem, Singapore Civil Defence Force (SCDF) realized the need to break from the conventional design and came out with a new concept and design of a fire engine with greater mobility and accessibility to fulfil their new operational requirements.

As an existing model of such a vehicle didn't exist in the industry worldwide, the project teams from DelGro Engineering and SCDF decided to jointly develop a new generation vehicle, called the Light Fire Attack Vehicle (LFAV).

The first 2 units of LFAV were put in operation in the second quarter 2000 and the 49 units of new LFAV vehicles have proven to be successful in many real operations.

Criterion and challenges for the LFAV development:

- Able to perform fire fighting and rescue operations, multifunctional
- Suitable for both on-road and off road movement
- Able to cross over drainage or barrier of reasonable size
- Able to drive a rear mounted 1900 l/min @ 10 bar water pump
- Able to drive150 l/min @ 120 bar high pressure mist pump
- Having an integrated hydraulic system with adjustable high pressure outlets – up to 800 bar for powering various range of rescue tools
- Height and width are less than 2 meters to give an access to all basement and multi-level car park facilities and back-yards of housing estates
- Convenient and easy for the fire fighter to launch swift operation.
- Aesthetically modern and compact
- Limited time frame for designing and building the vehicle.



Project Development

Besides the detailed operational requirements from SCDF, an exceptionally tight schedule was a challenge for implementing the project. A concurrent multiple tasking approach was adopted. Instead of the normal step-by-step development cycle, various activities were carried out concurrently, thus requiring strong communication and close coordination among SCDF and the engineering team:

Before the chassis arrived, the engineers came up with all preliminary design and a model was built to secure the final feedback on body configuration. The determinants were:

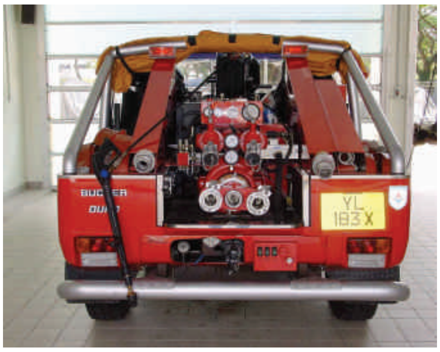
- Major Fire equipment location vs. body size constraints
- Major fire equipment vs. engine power-take-off
- The accessibility and operation efficiency of the user (fire-fighters) to the major fire equipment.
- Various ways to locate the rescue accessories.
- Adequate protection to the fire-fighting crew.

Prototype production started immediately with arrival of the raw chassis:

- The original chassis selected was for all terrain, left hand drive and used to be mounted with military vehicle body. Therefore with the purpose of adapting it to a small size fire truck, which operates critical fire rescue equipment, there was a need to re-align the steering linkage, power take off etc.
- Engineers had to proceed in parallel to re-align and re-configure some of the chassis subsystems to allow the purposely-designed body to be accommodated suitably.

In the design for operational efficiency, safety of the crew has been well taken care. As conventional fire engines require the crew cabin to be enclosed in case of accidental roll-over, the attempt to design an open concept vehicle exerts great demands on safety. Much effort was spent on designing a roll-cage, which can provide more than 3 times the static load protection for the vehicle and crew.

The entire development/prototyping was completed in 6 weeks time. Computer simulation was adopted to minimize design changes during the prototype production.



Body system layout – The layout is open concept, with functional equipment being installed at its best and most convenient position. The body and system layout was studied thoroughly such that the end product is both user friendly and user efficient. The well-designed equipment stowage compartment has greatly facilitated response actions during emergency.

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DECONTAMINATION –

Hughes Decon 5 mass decontamination unit

By Tony Hughes

DECONTAMINATION HAS ALWAYS been an integral part of the work undertaken by emergency services – providing essential first aid for casualties and protecting their personnel from the hazardous substances to which they are frequently exposed. However, what has changed over the years is the type of hazards they encounter. These can range from relatively harmless substances that can be removed with no more than a simple wash down to highly dangerous chemicals requiring specialised treatment. Add to this the threat of terrorist activity with the risk of large numbers of casualties exposed to nuclear, radiological, biological or chemical agents, and the list of potential contaminants grows ever longer.

Obviously, the emergency services can only work with the equipment that is available to them. Consequently, they are reliant on specialist manufacturers to deliver effective solutions and help them to stay one step ahead. This means close co-operation between the two; emergency services feeding back front line experience and manufacturers responding with improved products. Leading manufacturers also explore new decontamination techniques to deal with potential threats before they materialise. Such forward thinking is a key component in ensuring that emergency services can respond effectively. It also means that the choice of decontamination solutions is constantly widening enabling emergency service personnel to select a treatment that is precisely targeted at the specific task.

The days of the ‘one-size fits all’ response are long gone. Increasing sophistication in the types of threat and the growing range of hazardous substances involved has been matched by the choice of equipment and techniques.

Making the right choices when selecting equipment and deciding on the most appropriate response strategy is often as much a budgetary consideration as an operational one. It is therefore essential to understand the options and the way in which they can be used in response to different incidents.

By considering four different incidents we can explore the type of decontamination equipment required and equally important how it can be used to best effect.

ROAD TANKER ACCIDENT

The main contamination risk is from the tank contents that can range from harmless organic materials to highly toxic and corrosive chemicals. Although casualties may be exposed to the contents of the tank, it is usually the emergency service personnel responsible for containing the spillage and clearing the scene that have most need of decontamination facilities.

For incidents of this type a medium size decontamination shelter is invariably adequate for all incidents including the most serious and can be used to treat both casualties and emergency service personnel as well as small items of equipment. The nature of such incidents invariably means that any casualties will be treated and removed from the scene well before the emergency service personnel have completed their task and require the use of the decontamination equipment.

The inflatable shelter is highly portable, erected in minutes and designed to accommodate both walking and stretchered casualties. A built-in sump contains the contaminated wash-off for subsequent safe disposal. This facility is particularly important when dealing with highly toxic materials where direct discharge into the public drains could cause a pollution problem.

INDUSTRIAL CHEMICAL SPILLAGE

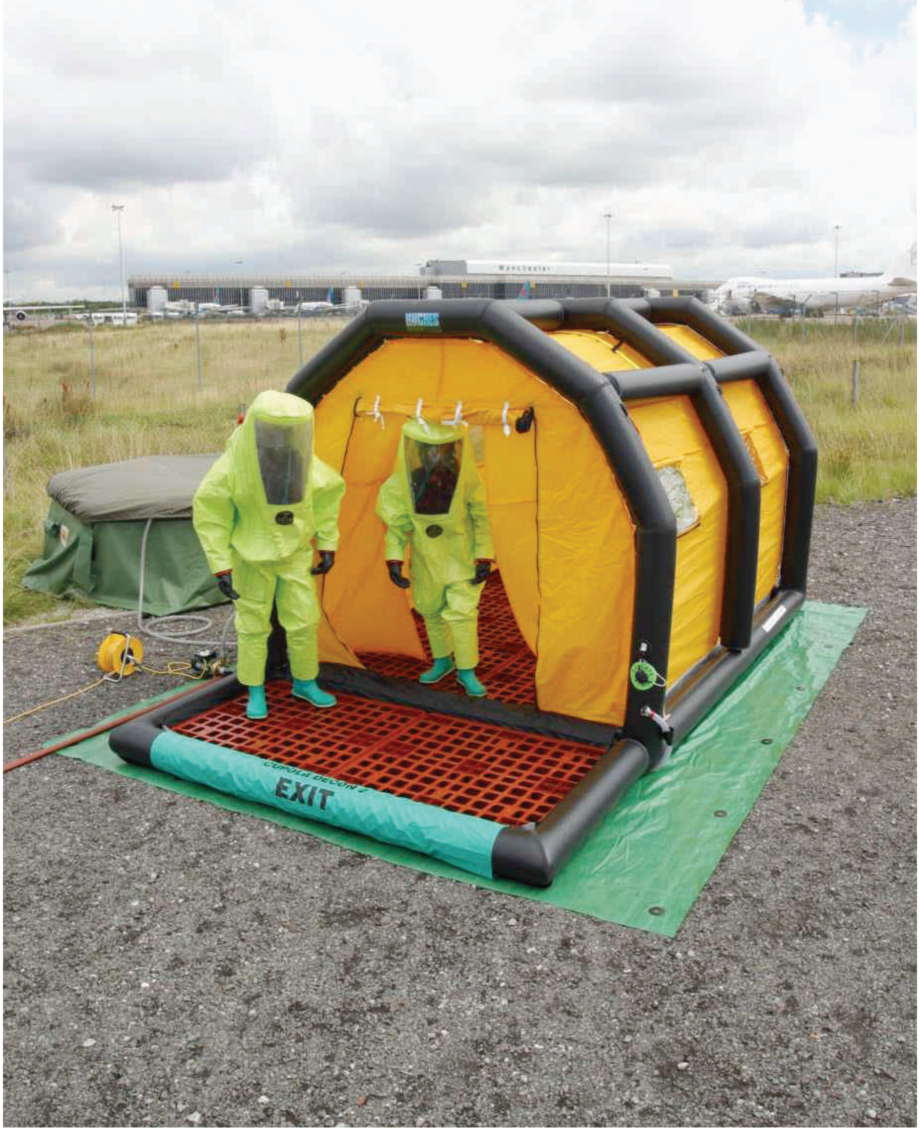
The same type of decontamination unit can be used for incidents involving spillages and leaks of chemicals in industry, and only in major incidents such as industrial explosions should larger units be necessary. However, in some instances, detergents or other chemical additives may be required in the wash water to ensure more effective decontamination.

making the right choices

These can be introduced in several ways, but the simplest and most reliable technique is to use some form of chemical inducer whereby the amount of additive drawn into the water supply is directly proportional to the flow rate. A twin inducer offers the best compromise between portability and flexibility. One or two different additives can be introduced alone or in combination to suit the specific contamination hazard and the actual flow rates can be adjusted within the design parameters of the particular inducer units, the sizes of which will vary according to the concentration levels that are required.

When decontaminating Emergency Services personnel, both high and low concentrations will be required and therefore inducers with typical ranges of 2–10% and 0.2–1.6% will be adequate.

The medium size decontamination shelter can also be used as a temporary store for leaking drums, which can be placed on the sump until they can be safely removed. Disposal of the sump contents, whether wash water from showering or leaking chemicals, needs careful consideration as direct discharge into the drains could pose an environmental hazard. Pallet mounted waste receptacles with anything up to 1000 litres capacity offer the best option as well as a convenient and safe method of storing and transporting contaminated clothing. They are usually made from heavy-duty woven polypropylene and have removable side panels for rigidity. When used for storing liquids, the receptacle is fitted with a polyethylene bag, which can be filled from the decontamination shelter's wastewater pump and then capped off when full while awaiting removal. Full receptacles can be easily moved with a fork truck and when not in use they can be folded flat and stacked for storage.



Hughes Decon 2 shelter is typical of the medium size units available for decontaminating both emergency services personnel and the public

> *Disposal of the sump contents, whether wash water from showering or leaking chemicals, needs careful consideration as direct discharge into the drains could pose an environmental hazard.*

TERRORIST SABOTAGE ATTACK

This could now include a threat from chemical, biological, radiological or

DECONTAMINATION – *making the right choices*

nuclear contamination and is likely to involve large numbers of casualties.

Separate provisions must be made for the emergency services personnel and the public. Whilst the medium size shelters, discussed earlier, are adequate for the decontamination of the emergency services, larger multi-channel units are required for decontaminating what could be large numbers of people both walking and stretchered. Here the emphasis is on speed and some of the latest units can process up to 300 people an hour.

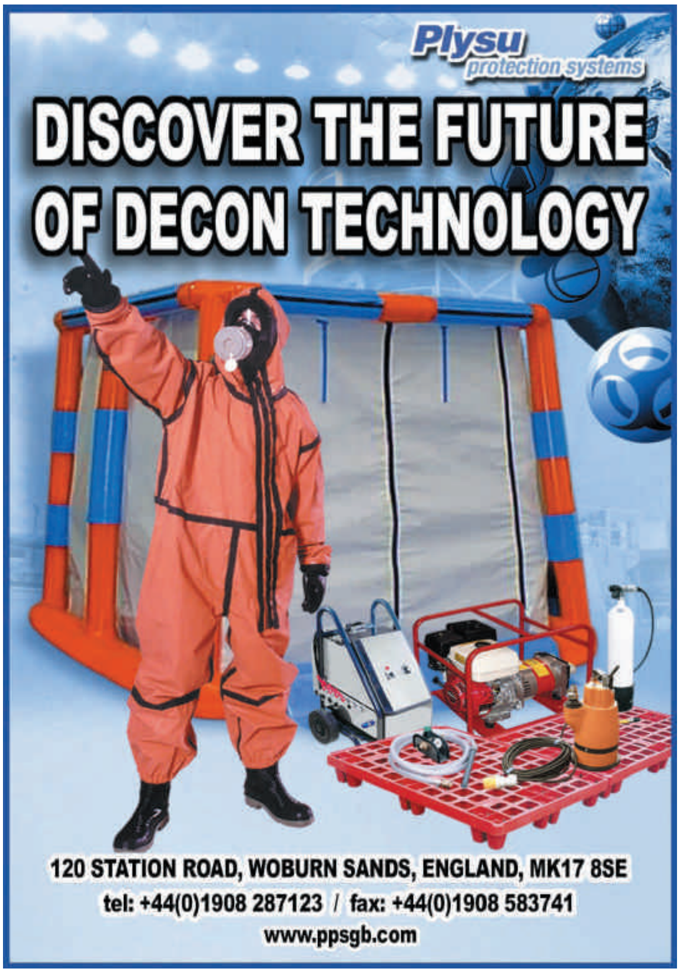
They provide protection from the elements, privacy during treatment and a controlled and comfortable decontamination environment. Systems are usually mounted on pallets ready for transporting to the scene of an incident and can be fully operational in less than ten minutes.

There are both inflatable and rigid framed units and they can be supplied with a range of ancillary equipment such as air and water heaters, waste collection facilities, chemical inducers, portable generators and lighting.

These decontamination shelters are fitted with a removable inner lining and partitions that can be arranged to suit different decontamination procedures. A typical five-section arrangement used for three-stage decontamination would have four sections for walking casualties and one for stretcher cases. By re-arranging the internal partitions more space can be allocated to stretcher cases or, by removing them completely, the system can be used as a holding area or first-aid centre.

Alternatively, shelters can be configured to process groups of people, say ten at a time, segregated into male and female streams. Casualties first disrobe in a separate section, which is either an integral part of the shelter or a separate but attached enclosure. They then move into the main decontamination area and stand in line. They are decontaminated simultaneously at separate showering positions, which include overhead and chest height nozzles. On completion they move out together into a re-robing area.

All of these shelters, in their different configurations, are extremely effective but particular attention should be paid to decontamination of the feet, particularly the soles, and the hands, as these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Mist systems are used to decontaminate confined spaces avoiding the potential damage caused by water sprays

are the parts of the body most frequently missed. One solution, as far as the feet are concerned, is to create a sump of neutralizing chemical through which casualties must pass before entering the showering area. A hand pad operated spray could also be provided at this point for the hands with a built in delay on the shut-off valve to ensure that when the hand pad is released, any residual contamination is washed off before the next person uses it.

The complete package must be capable of being easily transported and quickly deployed. The UK emergency services, for example, are using dedicated trailers and vehicles with the complete range of equipment mounted on pallets for ease of handling.

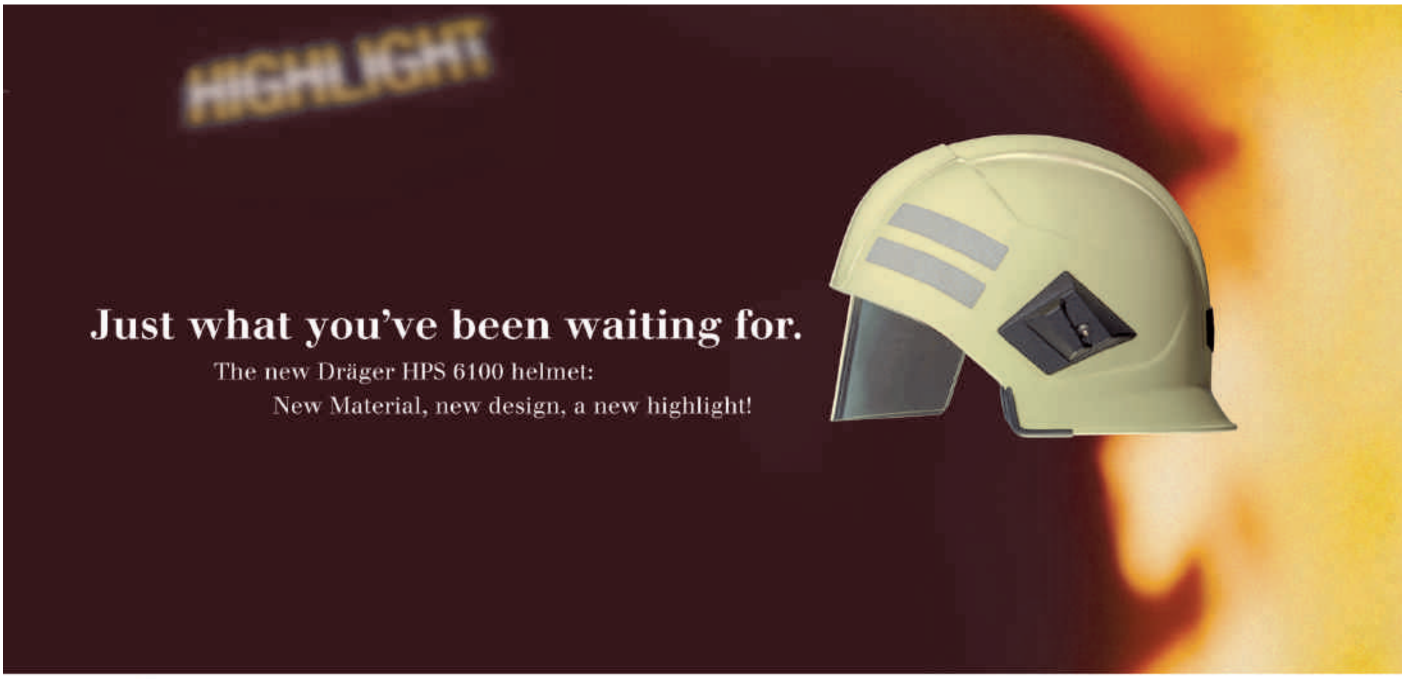
Consideration also has to be given to the comfort and security of casualties in mass decontamination situations. Pre and post decontamination packs should be prepared containing suitable disposable garments, footwear and hygiene items. Sealable bags should be provided so that contaminated clothing can be disposed of safely. Security sealed bags are necessary for the safe storage of valuables and these should have a unique number which corresponds with the number on an identity wrist band given to each casualty.

ANTHRAX THREAT IN COMMERCIAL PREMISES

Anthrax and similar airborne contaminants have already proved very disruptive and difficult to contend with and consequently require special methods over and above those already described.

The primary requirement is to contain and neutralise the threat as quickly as possible.

Foam and mist systems are increasingly popular and both aim to suppress the contaminant while at the same



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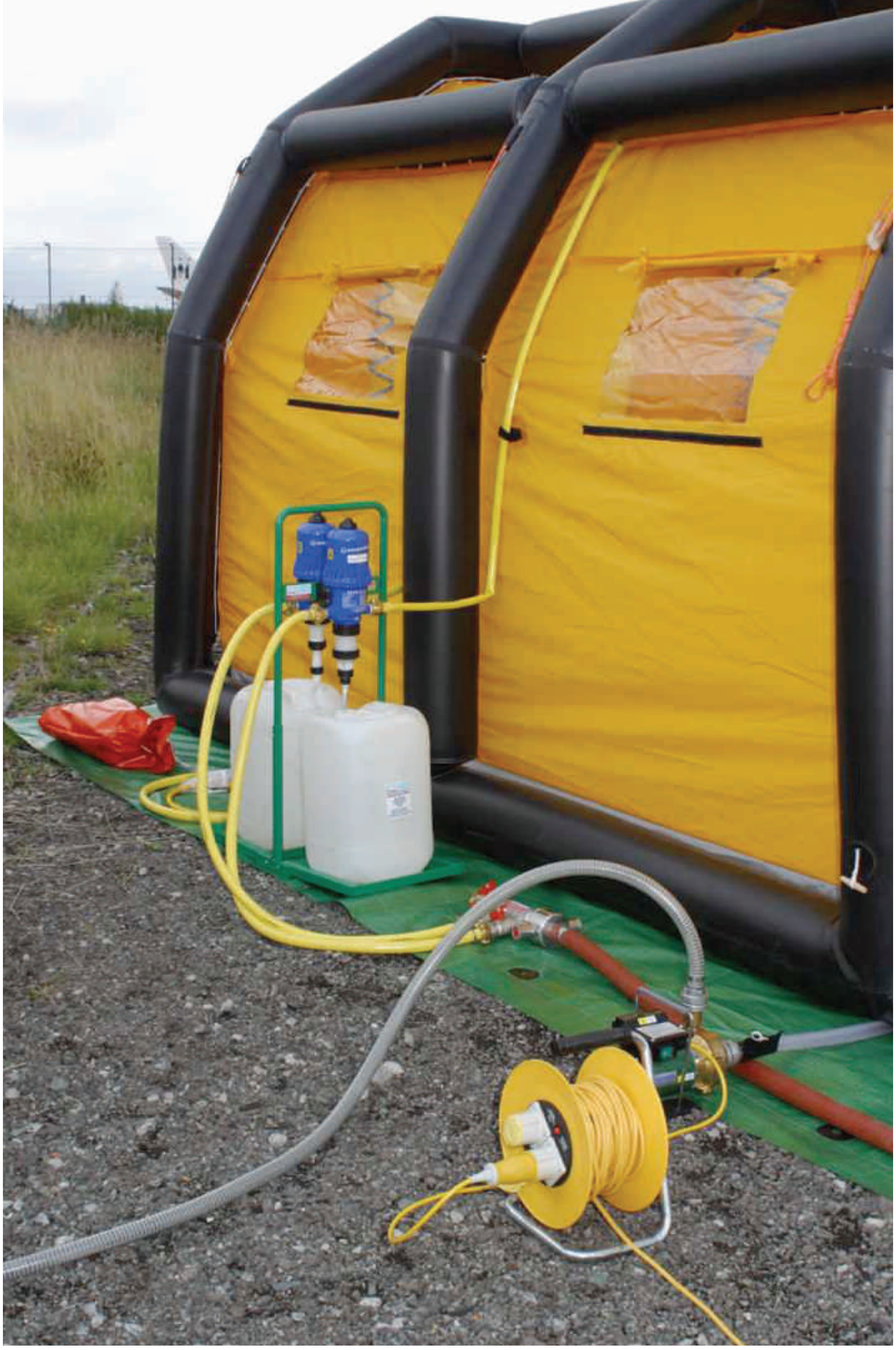

A twin inducer for introducing precise volumes of neutralising chemicals, detergents or disinfectants into the showering water supply

time neutralising the threat.

Foam based systems tend to be used on structural surfaces, large equipment and vehicles. They are either mounted on a trolley or in a backpack for maximum portability and deliver a thick, sticky foam that adheres to surfaces and traps the contamination whilst neutralizing it. The foam immediately suppresses vapour and powder to minimize the risk of dispersal. Foam bubbles have a scouring effect on contaminated surfaces, and the addition of a solvent can further improve the penetration and effectiveness of the neutralising agents.

Once decontamination is completed, the neutralised chemicals can be washed from the affected surfaces using a portable jet washer. During this final wash-off stage, there is further opportunity to add chemicals as a precautionary measure to complete the process.

In confined spaces, or where sensitive equipment is involved, an atomised spray is more effective. It quickly disperses throughout the treated area and condenses on all surfaces to provide uniform coverage. This eliminates the risk of wetting or excessive exposure associated with normal spray nozzles, which could damage equipment.

A dilute neutralising agent is delivered by compressed air, fed from a standard breathing apparatus cylinder,

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> *In confined spaces, or where sensitive equipment is involved, an atomised spray is more effective. It quickly disperses throughout the treated area and condenses on all surfaces to provide uniform coverage.*

to a hand held ultrasonic spray head where it is atomised into a dense fog.

The same system can be used to decontaminate the inside of protective suits delivering a fine mist that disperses evenly throughout the suit to ensuring uniform treatment of all internal surfaces.

NEUTRALIZING AGENTS

While water remains the main method of removing contamination from both the skin and protective equipment, chemical additives can significantly enhance the effectiveness of the process. In the tanker accident or industrial chemical spillage, emergency services would invariably be aware of the specific type of hazard and therefore the chemicals and actions necessary to neutralise it. However, when treating the skin, especially in mass decontamination, uncertainty about the substances involved may call for a broader based solution. For example, Diphoterin® is a neutralising agent that can be used effectively on a wide range of chemicals including nerve agents. It reverses the normal action of water on the skin and draws the potentially damaging contaminant to the surface where it can be more easily washed off. The speed of treatment in any incident is critical and this type of additive can significantly reduce the degree of damage caused. It is easily introduced into the shower water supply using the inducers described earlier and can be safely used on any part of the body.

SUMMARY

Understandably, in dealing with contamination, the emergency services invariably play a reactive rather than proactive role. Consequently, and quite wrongly, this can be interpreted to suggest that they are inevitably one step behind in their approach to dealing with hazardous incidents. Of course, nothing could be further from the truth – but such perceptions can seriously affect public confidence, and in turn, are critical in shaping policy and attracting resources where they are most needed.

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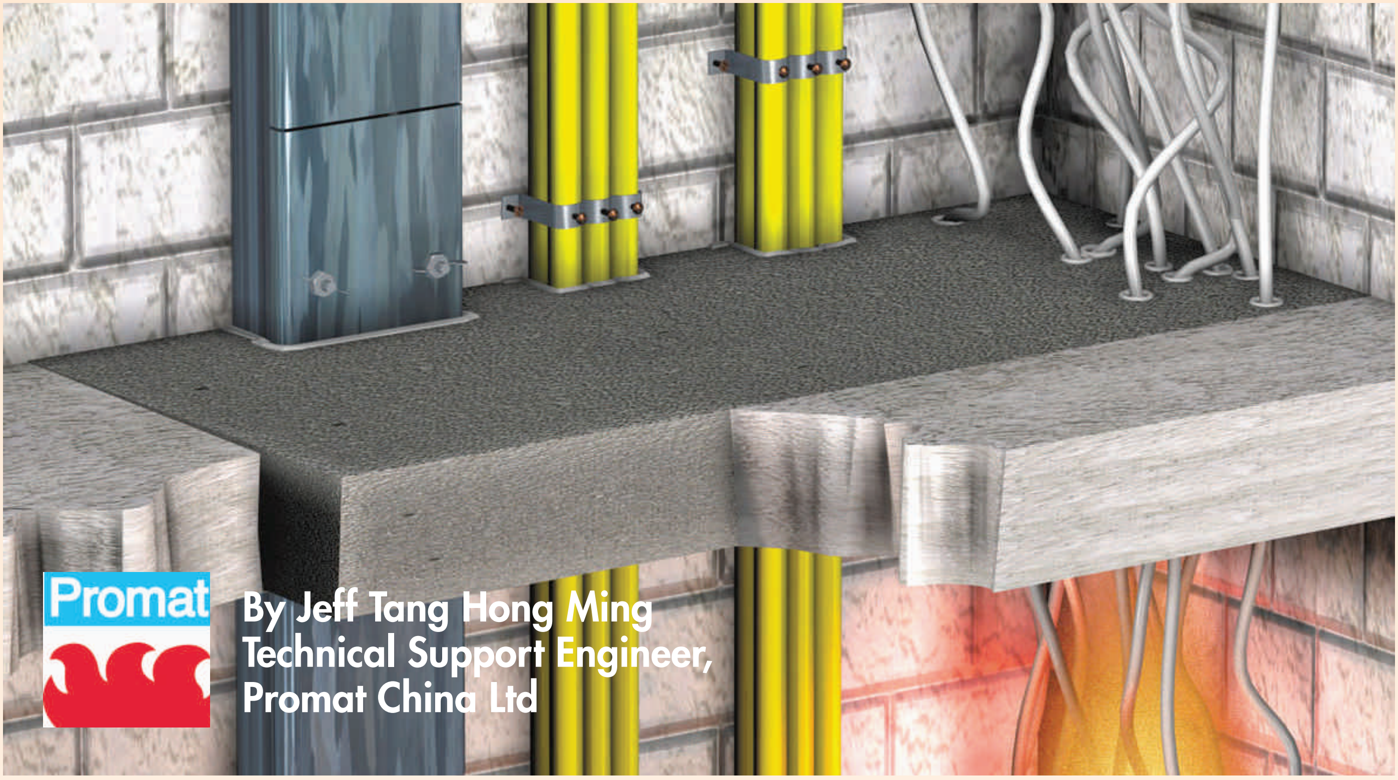
The Importance of



By Jeff Tang Hong Ming
Technical Support Engineer,
Promat China Ltd

Load bearing fire resistant mortar barrier

THE NEW EURO STANDARD EN 1366-3, entitled "Fire resistance tests for service installations-Part 3, penetration seals" defines a penetration as "an aperture through a separating element for the passage of a service". Service is defined as "a system to convey substance, for example a cable, conduit, pipe with or without any insulation, duct, chimney, or trucking; excluding air ventilation system, fire rated ventilation ducts, fire rated service ducts and shafts and smoke extraction ducts".

The new standard defines a penetration seal as "the system used to maintain the fire resistance of a separating element at the position where there is provision for services to pass through the separating element".

Why should we pay more attentions to penetration seals?

The importance of penetration seals cannot be over stated. Experience shows that penetrations tend to be the weakest link in the chain of compartmentation within buildings.

Penetration seals are mainly used in conjunction with "compartmentation". A compartment is defined as "a building or part of a building, comprising one or more rooms, spaces or storeys, constructed to prevent the spread of fire to or from another part of the same building, or an adjoining building.

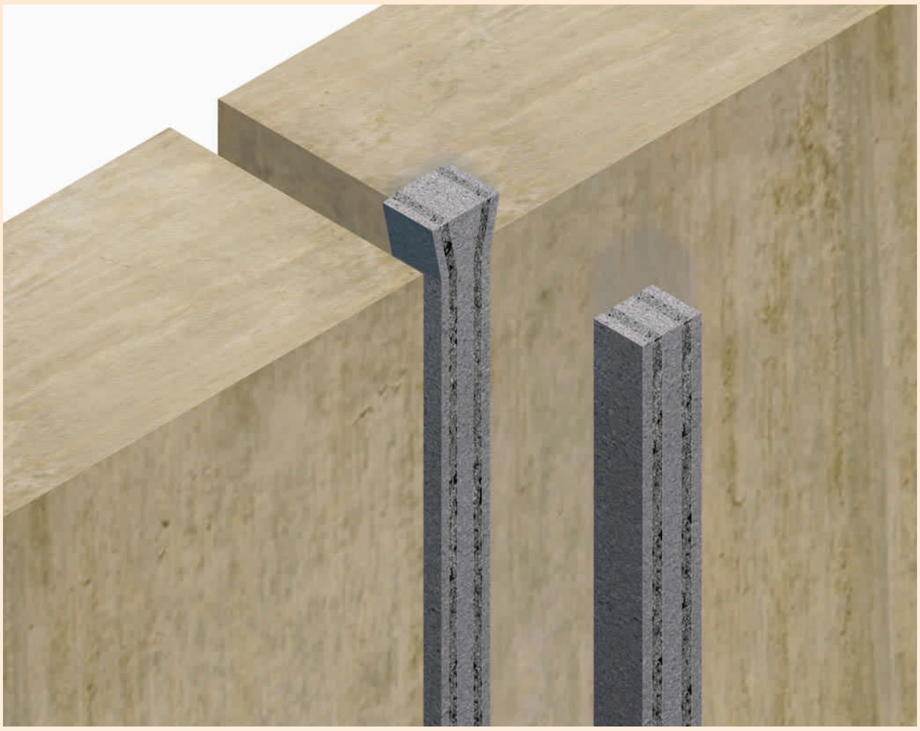
We should all be aware that in such building "compartments" the most likely threat from the spread of fire will occur where services penetrate walls or floors, or where concealed cavities between separating elements interlink. Unfortunately, the lack of seals, incorrect specification and incorrect installation has contributed to many large fires in all buildings, both new and old, which would not have been so destructive if the penetrations through compartment walls and floors had been adequately sealed against the passage of fire and smoke, or that seals had been properly specified.

The main objective of compartmentation is to prevent the spread of fire within or between adjoining buildings. In this respect the inter-reaction between the elements of construction, roofs, doors, linear gap seals and service penetration seals all play an important role in achieving an acceptable solution for preventing the spread of fire and smoke throughout a building. This is especially important when considering how one particular element can affect another in a fire.

The integrity and insulation of compartment walls, floors and penetration seals through such elements, need to be carefully checked in order to ensure they will provide the fire resistance required. Integrity is fully understood, in so much as we all appreciate the element and the penetration seal must remain in place without developing fissures or holes through which flames or smoke can pass in a fire. Insulation, however, is often overlooked and there appears to be a lack of understanding of this important aspect of passive fire protection. Basically, in the case of compartment walls, floors and associated penetration seals, the temperature on the face unexposed to the fire should not rise more than 140°C above ambient, or 180°C in any one spot. This requirement is of prime importance and must not be ignored, especially in situations where combustible items are situated close to, or in contact with, a wall or floor. It should also be noted that the insulation criteria applies equally to both the penetration seal itself, AND the services which pass through the seal.

THE DIFFERING TYPES OF PENETRATION SEALS

For different services that penetrate separating elements, such as cables, cable bundles, plastic pipes, steel pipes, pipes with/without insulations etc, different penetration sealing products and systems will be needed due to the different reaction in fire of the various penetration materials. In addition attention need be paid to those areas where the seals are required to form a load-bearing function and where the movement of the services movement due to thermal expansion/contraction etc may take place. All of these are important factors for which consideration in both the design and installation of any system requires attention.



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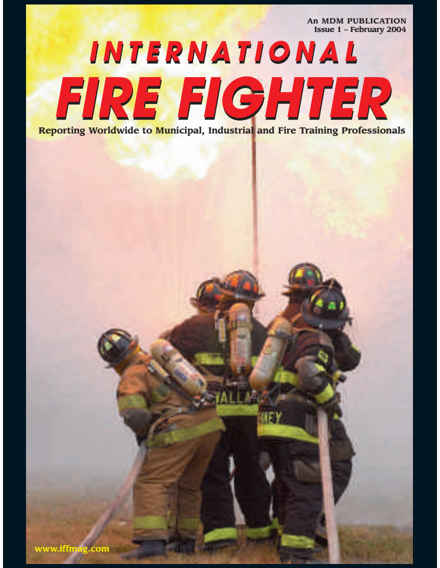

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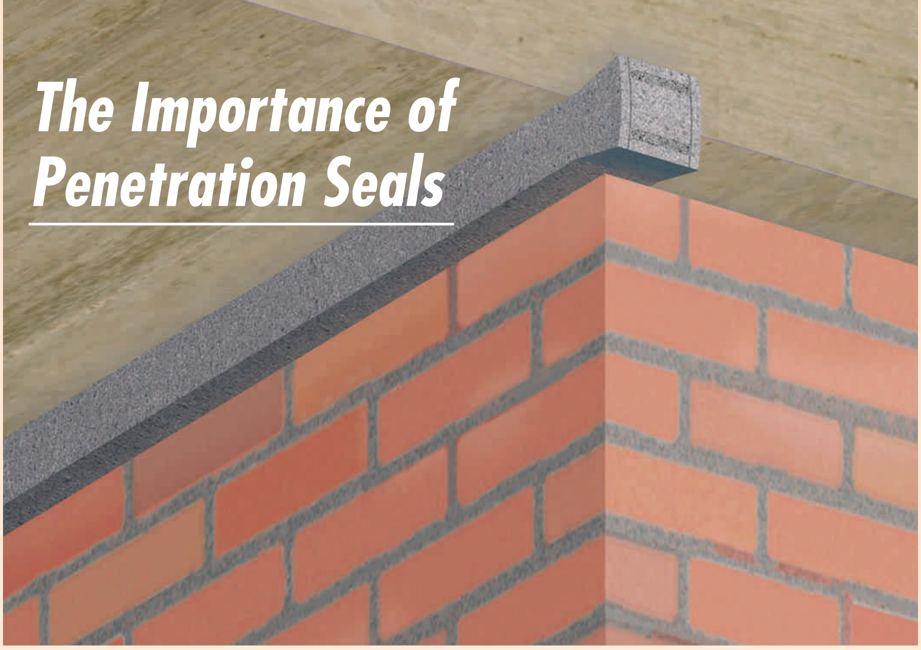
The Importance of Penetration Seals



Movement joints between walls and floors

COMBUSTIBLE PENETRATIONS

Electrical and communication cables or cable bundles, plastic pipes and some insulation products used for pipe or ductwork lagging will burn. These are all potential points of failure. Small single cables do not present much of a problem, as they tend to extinguish themselves at their junction with the penetration seal. A large number of cables (bundles) will cause difficulties and although cables should be protected each side of the seal, in order to provide an exclusion zone, care should be taken to ensure the cables do not overheat and degrade their designed electrical capacity.

Plastic pipes are less of a worry, as an intumescent collar, or wrap, can be fitted around the pipe. These collars or wraps will crush and close the pipe in the event of a fire and will prevent flames and smoke passing through it. If there is a gap between the pipe and pipe sleeve it is likely that an additional "cold smoke" seal may be required as the collar will not operate until the temperature is sufficient to activate the intumescent seal. However, different types of plastic behave very different under fire conditions, as do different wall thickness of the same plastic type. Extreme care therefore should be taken to ensure that the chosen pipe collar or wrap has been fully tested to show it is capable of providing the requisite performance under fire conditions for both the plastic type, thickness and diameter. It should be noted that it does not follow that all plastics, of all dimensions and thicknesses behave in similar manners; on the contrary, there can be marked differences in the performance between for example a 50mm and 150mm diameter of the same plastic type and thickness, similarly there can be marked differences between two 110mm diameter pipes with either a 2mm or 10mm thickness of the same plastic type.

LOAD-BEARING SEALS

Most services in high-rise buildings feed the floors via a vertical riser, which, unless contained within a fire rated shaft, requires sealing at each floor level. These are often large areas, which are accessible by doors to enable maintenance personnel to gain access to the equipment and services. This means that in many cases, the horizontal penetration seals must be capable of withstanding, at the very least, the point load of a ladder and a maintenance engineer with tools.

Different materials and systems obviously provide different physical properties and it is therefore very difficult to provide a definitive method for supporting such seals. Generally, the support is achieved by the fitting of a secured metal grid system under the penetration seal, or by fitting reinforcement within the thickness of the material. When specifying a load-bearing seal, it is always better to specify the anticipated loading required.

PENETRATIONS AND SERVICES MOVEMENT

A compartment wall, if built with masonry or concrete, and has correctly constructed expansion joints, will perform well in the event of a fire. Any penetration seal should remain stable within the wall. In modern construction however, dry lining systems are frequently used. A fire rated dry lining partition is designed to take account of expansion and movement in a fire. The movement is often up to, and some time exceeds, 100mm in both vertical expansion (or horizontal in the case of ceiling membrane constructions) and severe bowing of the wall will take place. The building services penetrating the partition are invariably fixed rigidly to the underside of a concrete floor and there can be great differential movement between the partition and the services. If the penetration seal around the services is not designed and installed to cope with this movement, the seal will fail thus smoke and flame will pass though the partition. Not only will smoke and fire pass through the hole left by the failure of the seal, the inner faces of the dry lining structure will also be exposed to the fire. It will be appreciated that if such a partition is constructed with a lightweight metal framework, it will very quickly distort and fail.

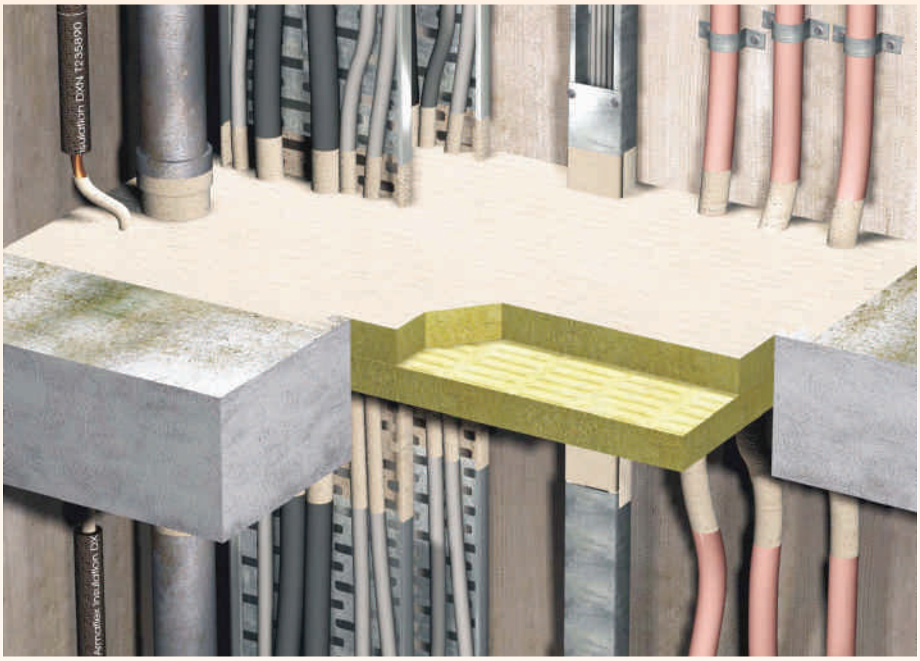
Frequently, an aperture is left in a wall at its junction with a floor (ceiling) to allow services to pass through. Any ductwork, pipes, conduit, etc., which are supported by hangers fixed to the suffix of the floor will remain in place in despite of the movement of the wall. Such penetrations should therefore be sealed with flexible materials and NOT with a rigid material. Once the amount of movement has been established it is possible to design a seal that will provide many years of trouble free service. The use of high movement compounds, slip joints, and/or fire rated fabrics will be required for services such as hot water and steam pipes, etc., which can expand significantly in long runs.

It is also essential to check that the materials being used for the penetration seal have been tested in a lightweight partition. Materials tested for use in a brick or block wall are not always suitable for use as seals in a dry lining partition.

Specification and Installation of Penetration Seals

- Establish the type, size and number(s) of the service(s) passing through the wall or floor
- Determine the construction materials used for the wall or floor, and the size of the penetration
- Check for any possible differential movement of the structural elements within the building
- Determine the likely maximum movement of the service pipes/services
- Check if the seal has a requirement to be load-bearing
- Determine a system, which is compatible to both the element (wall/floor) and the penetration sealing system
- Establish the working environmental conditions within the building (in areas of high humidity certain materials could break down)

The above list is by no means definitive but will give an indication of some of the questions, which need to be resolved prior to commencing any installation.



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EVAC-U8® is priced at US$69.95. It has a five-year shelf life, and each unit comes with a convenient wall mount for easy storage.

EVAC-U8™ is manufactured in Canada by **Brookdale** (a DuPont Canada company).

For further information, please contact:
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Two versions of the detector are available to cover distances up to 50 m and 100 m. Correct installation is ensured by a simple alignment aid: coloured flashing LEDs indicate when the detector is precisely aligned with the reflector for optimum signal strength.

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An ultra-compact positive pressure ventilation (PPV) smoke ventilator from French company **Groupe Leader**, the MT236 has the best airflow/size ratio on the market. Already the leader in its category in Europe, the MT 236 has become an essential tool for fire-fighters.

The airflow from the MT236 can reach 36,000m^3/h. This capacity ensures rapid smoke exhaustion, an immediate fall in temperature and the return of visibility conditions that are essential for the effectiveness of rescue teams saving victims.

The powerful air jet is driven by a resin turbine, and an enveloping frame protects all the components of the PPV ventilator. As its dimensions are reduced to the minimum, the MT236 can easily be housed in any vehicle.

The MT236 is part of the MT200 range designed by Groupe Leader, which consists of four portable 4-stroke engine PPV ventilators for use by fire-fighters in smoke-filled premises. With rapid smoke extraction, this equipment ensures better visibility, lower temperature and a reduction in toxicity. Their size and design makes all the models in this range stable and easy to handle and transport.

In order to expand internationally, Groupe Leader seeks trade partners for the distribution of its products.

For more information, please contact:
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THE HI-FOG TUNNEL SOLUTION

Marioff's HI-FOG tunnel concept is based on utilising high-pressure water mist sprinklers together with water mist curtains. The sprinklers activate at the location of the fire whereas the water mist curtains restrict the heat spread and consequent activation of sprinklers further away from the fire. A thermal bulb activated sprinkler system, divided into zones with water mist curtains, will self-activate in the right location without complex detection interfaces. This means that the water flow requirement is minimised, small size piping can be used, and installation is straightforward.

In the fire tests carried out by Marioff, the correct zone was quickly activated, no additional sprinklers were activated, and the temperatures were quickly cooled down and kept at safe levels. In order to operate, the system requires no additional detection and the pump-unit for a tunnel of 10km would be a similar size to that fitted on a large cruise ship. Any length of tunnel can be economically protected with HI-FOG water mist. For tunnels with a detection system, a zoned deluge system is available.

Water mist is ideal in tunnel fire protection thanks to its efficient cooling capabilities. It quickly makes the thermal conditions much more tenable for evacuation and for rescue. Fire tests and calculations show that there are usually 'false' activations of conventional sprinkler systems even at large distances from the fire caused by hot gas currents. This would put enormous demands on the water flow, making a conventional system totally impractical for long tunnels. High-pressure water mist has been proven to operate effectively within typical wind conditions of road and rail tunnels.

For more information please contact:
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MSA GALLET the European market leader in Head Protection is now part of MSA, the World's leading provider in **Total Safety Solutions** with the widest range in Personal Protective Equipment (PPE) and Gas Detection Instruments in the marketplace today.

In May 2002, MSA (the Mine Safety Appliances) Company officially completed the acquisition of CGF GALLET, located in Châtillon-sur-Chalaronne, France and it became MSA GALLET.

To support this new member to the MSA Family, a rollout programme was launched on MSA GALLET's product range within MSA's worldwide affiliates. This program was designed to introduce and provide a complete sales training programme and after-sales service network exclusively through MSA's worldwide distribution channels. As a result, customers who purchase MSA GALLET products now benefit immediately from MSA's international support network and after-sales service.

Besides the famous F1 range of fire fighting helmets, MSA GALLET is also the manufacturer of F2 helmet for search & rescue services, such as high angle rescue in mountains and forest fire fighting etc.

This helmet is well known for its **light weight** (only 580 g without goggles), **comfort and multifunction.** The high performance outer shell is made from an auto-extinguishing technopolymer material with vent holes which provides excellent ventilation as well as fire protection. The helmet is equipped with two shock absorption paddings and a non-flammable cradle to give the best overall user comfort all the time. A leather-covered headband allows easy adjustment from 53 to 63 cm and a 3-point retention system to ensure secure fit and stability. For a maximum protection, the helmet is also equipped with a tinted double-screen goggle made from polycarbonate to protect against shocks, projectiles, smoke and splashes.

The F2 helmet is also designed to integrate with various options, such as:

- a powerful photoluminescent flashlight which can be easily recognized in the darkness.
- radio communication systems of MSA GALLET.
- Retroreflective stickers which can be personalized according to customer requirements.

In keeping with international standards, the F2 helmet is CE marked according to European specifications and approved by UIAA (International Union of Alpine Associations). To maintain the highest quality, the MSA GALLET facility based in Châtillon-sur-Chalaronne (France) is certified to ISO 9001.

For more information please contact:
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APF IS PUBLISHED 4 TIMES A YEAR – MARCH, JUNE, SEPTEMBER AND DECEMBER

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Subscription Rates: Sterling £35.00 AUS Dollars – $100.00
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Back Issues: US $8.00 or £5.00 each inclusive of P&P
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METHODS OF PAYMENT:

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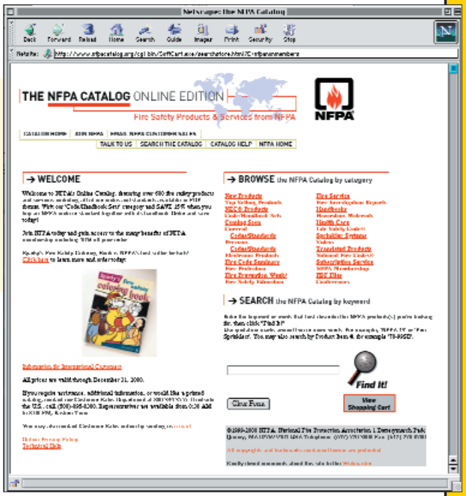
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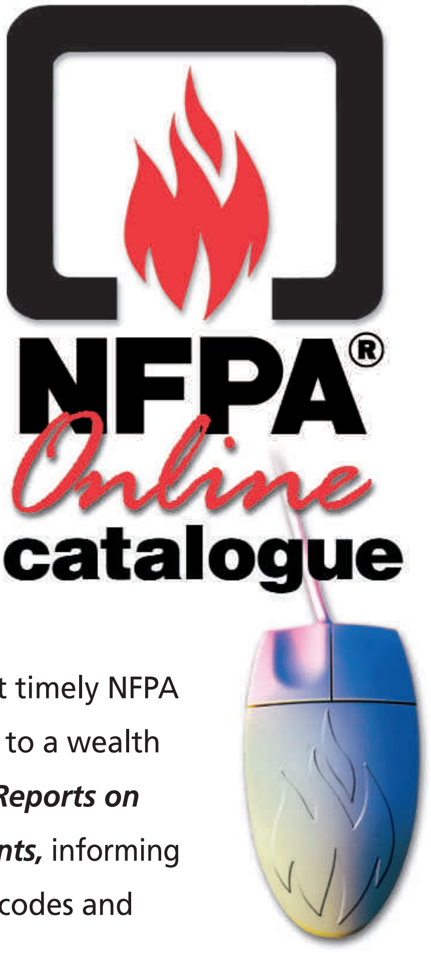

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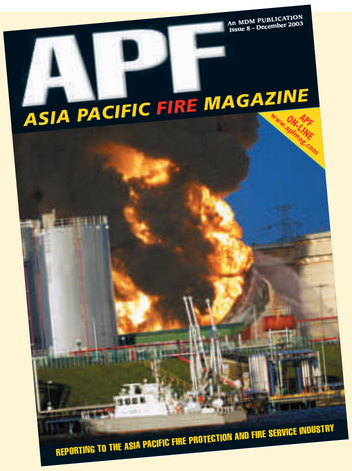
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Front cover picture: Oil storage tank burns following after shock in Tomakomai, Northern Japan.
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Publishers
Mark Seton & David Staddon

Editorial Contributors
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APF is published quarterly by:
MDM Publishing Ltd
18a, St James Street,
South Petherton, Somerset TA13 5BW
United Kingdom
Tel: +44 (0) 1460 249199
Fax: +44 (0) 1460 249292
e-mail: apfmag@globalnet.co.uk
website: www.apfmag.com

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Periodical Postage paid at Charnplain New York and additional offices
POSTMASTER: Send address changes to IMS of New York, P 0 Box 1518
Champlain NY 12919-1518
USAUSPS No. (To be confirmed)

Subscription Rates
Sterling – £35.00 AUS Dollars – $100.00
US Dollars – $55.00
(Prices include Postage and Packing)
ISSN – 1476-1386

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Page design by Dorchester Typesetting Group Ltd
Printed by The Friary Press Ltd

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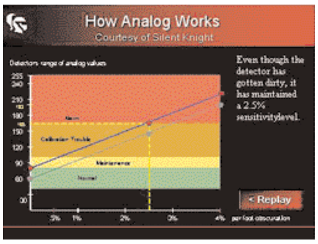

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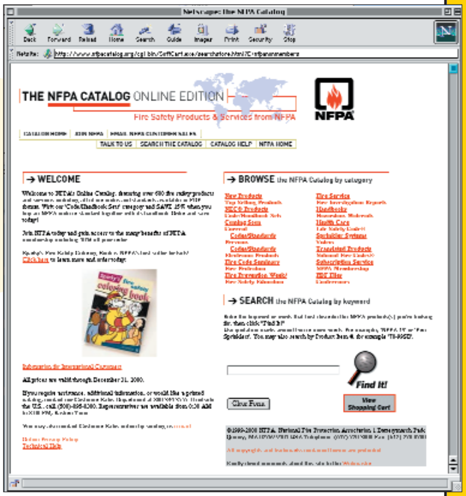
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FOREWORD

by Jeff Godfredson

NFPA's Asia-Pacific Operations Director

What does it take to learn the lessons of the past

Recently, I was contacted by a colleague who wanted to know examples of where legislation has changed as a result of fire disasters. There are many, many examples of where a major fire occurred resulting in significant loss of life and the legislation to make buildings safer followed. Some include the Asch fire in New York (1911), the MGM Grand fire in Las Vegas (1980) and more recently the nightclub fire in Rhode Island (2003). All resulted in changes to legislation. There are other examples from other parts of the world including the Garley fire in Hong Kong (1996)

Each of these fires caused significant loss of life and the immediate reaction of the Government for that location was to create new laws, which would make a similar occurrence less likely to have the same outcome. The changes usually relate to requiring more stringent requirements for exits and additional fire protection such as sprinklers.

From my own experience in Australia and from my observations elsewhere in the world there seemed to be a need for multiple events before Governments were prepared to act (e.g. Backpackers Hostels and Nursing homes.)

In the US there were recently two tragic fires in Nursing homes. A fire at a four-story nursing home in Nashville, TN, on September 25, 2003, killed 15 residents and injured 28 others. In February 2003, a fire tore through the Greenwood Health Center nursing home in Hartford, CT, killing 16 people. As a result of these events NFPA President, Jim Shannon has called for all Nursing homes to be fitted with sprinklers. It will be interesting to see which jurisdictions accept the challenge.

Something that I have observed is that although we know that many people die in fires in nightclubs and nursing homes it seems that Governments will not act unless the events occur in their own jurisdiction (electorate) When fires occur in such locations officials react by calling them terrible accidents. Whilst the cause may well be accidental it is no surprise that after the fire started the consequences will probably be horrific if exits are inadequate or blocked or there is a lack of fire suppression installed.

In some jurisdictions there are courageous legislators who are prepared to learn the lessons from others and prepared to be proactive before similar disasters occur in their own locations. Unfortunately these are in the minority.

One thing that is certain it that until the problems are rectified in these premises these disasters will continue to occur.

Jeff Godfredson
NFPA's Asia-Pacific Operations Director

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By Mike Willson

Selecting the Right Foam for Your Application

Non-aspirated application of multipurpose Niagara AR-FFFP from Angus Fire

FIRE FIGHTING FOAMS are widely used to control and extinguish fires involving Class B flammable liquids. They are also used as additives to improve the wetting characteristics of water on Class A fires. A bewildering choice of foam types, grades, manufacturers and brands is available, so how do you know which one is right for your particular application? Following this step-by-step guide will help you select the right foam type and could act as a useful crosscheck to ensure the foam you are currently using is really the right one for your specific applications.

WHAT FUEL(S) ARE INVOLVED?

The place to start when selecting the right foam type is with the hazard you are trying to protect. The main hazard is normally defined as the type of liquid fuel that represents the fire risk in the area or facility and the way it is stored, its relative depth and the likely scenario of an incident.

HYDROCARBONS

Standard fire fighting foam types including P (Basic Protein), SD (Synthetic Detergent), FP (FluoroProtein), AFFFs (Aqueous Film Forming Foam) and FFFP (Film Forming FluoroProtein) are designed for use on hydrocarbon fuels. These include anything from the volatile Class 1 hydrocarbons like Crude Oil, Naptha, Benzene and Gasoline to the less volatile Class 2 products like Diesel, Avtur and Fuel Oils. Hydrocarbons can easily be identified, as they do not mix with water. Pour water into a jar of gasoline, and it immediately sinks to the bottom with the fuel floating on top of the water. Even when shaken well they immediately separate into 2 layers once you stop. Oil and water just do not mix!

Applying water alone to such hazards causes them to burn more ferociously and overflow their containment areas sending a flaming river of fuel into other previously unaffected areas, dramatically escalating the incident so that it is harder to control the flames and extinguish them.

Fire fighting foams are therefore used to lay an aspirated blanket on top of the fuel. The bubbles smother the fuel surface to prevent the ingress of oxygen, prevent vapours from reaching the flames, and cool the fuel and surrounding area with the water locked up in the foam blanket. The longer the foam blanket stays in place, the longer it protects against possible re-ignition. This blanket may need to be replenished from time to time, before the incident can be declared safe.

SHALLOW SPILLS

Such hazards are normally burning for very short periods before a foam attack is made and as such are often termed "cool fires" as the temperature of the fuel involved does not increase dramatically and is usually below around 50°C. This means that non-aspirated film forming foams will work on such hydrocarbon spills whether occurring in process areas, tanker loading bays, marine jetties and ports or airport crash scenarios. Historically AFFFs developed in the 1960s were the favoured foam for such applications but increasingly the more modern FFFPs are now taking over as the modern foam of choice for such hazards since they are equally fast to knockdown the fire as AFFF's, but with additional important benefits:

- Minimised fuel pick-up
- Superior post fire security
- No emulsification with the hydrocarbon so fuel is not carried past on-site oil/water separators
- No increased risk of ignition on un-ignited diesel/Avtur type fuel spills
- Increased safety for firefighters and rescue teams

DEEPER POOLS

Deeper fuel hazards often occur from bulk fuel storage or spillages which are partially or completely contained, for example in bunded or diked areas, bulk storage tanks, pipeline fractures, valve failures, marine cargos etc. Fires in these areas have a tendency to burn for longer before a foam attack can be made and are often called "hot fires" as fuel temperatures can rise well above 100°C. In tank fires surface fuel temperatures have been shown to reach up to around 400°C after burning for about one hour.

Few people realise that studies done by the US Military have shown that film formation does not occur on hydrocarbon fuels above about 70-90°C, depending on fuel type. Extinction in "hot fires" is entirely dependent upon the quality of the foam bubbles produced, and so one is therefore reliant upon a semi-aspirated nozzle or aspirated foam cannon for such applications.

AFFF UNSUITABLE

AFFF type foam bubbles are weak and drain down quickly so are far less effective on hot hydrocarbon fires. Detergent based foams generally are more susceptible to bubble collapse from radiated heat and

Angus FP70 Plus tackling unleaded gasoline

breakdown by the flame front than natural protein based products, and so AFFFs are not recommended for such applications.

The most cost-effective foam of choice for such deep seated hydrocarbon fires is a high quality FP (FluroProtein) foam like the acknowledged world leader for bulk storage tanks FP70. These FP foams can be applied using base injection (sub-surface) techniques where the foam is aggressively mixed with the fuel through the depth of fuel in the tank and still achieves a good extinction result with accompanying good post-fire security.

FP DELIVERS

These FP products have specific benefits for deep-seated fires, putting them out and more difficult still – keeping them out!

- Exceptional resistance to fuel pick up
- No emulsification with hydrocarbons
- Complex FP bubble structure produces slow draining bubbles
- Complex FP bubble structure resists collapse from radiant heat
- Foam bubble blanket keeps cooling water at the fuel surface for longer
- Foam blanket protects for longer against re-ignition risks
- Better sealing against hot metal
- Better rsistance to flame attack
- Better post fire security

LASTFIRE PROTOCOL

The recent LASTFIRE test protocol, developed by 16 of the world's leading oil companies specifically to mimic the very tough conditions in a bulk storage tank fire, has shown that FP70 Plus is the most cost-effective response for bulk storage tank hazards. FP70 Plus also has special capabilities for MTBE (Methyl Tertiary Butyl Ether) and MTBE/Gasoline blends of unleaded fuels. Those with existing FP foams would do well to consider upgrading their stocks to FP70 Plus, as it has proven to be superior for tank applications to many of the much more expensive AR type foams when tested by LASTFIRE.

These more expensive AR-AFFF and AR-FFFP foam types are also suitable for such deep seated hydrocarbon fires because of their additional polymer content which mimics the FP foam characteristics and gives them all-round multi-purpose capabilities.

POLAR SOLVENTS

Special Multi-purpose or Alcohol Resistant (AR) type foams are required when these more aggressive polar solvent flammable liquids are involved. This could be either in storage alone of a single polar solvent, grouped storage of different polar solvent fuels or mixed with hydrocarbon fuels.

Polar solvents are very common in the Petrochemical, Pharmaceutical and Chemical industries as well as industrial flammable stores, maintenance areas and Do-It-Yourself warehousing.

WATER MISCIBLE HAZARDS

Unlike hydrocarbons, water miscible polar solvents mix readily with water to make a homogeneous mixture. There is no separation whatsoever.

This polar solvent group is very large and includes a wide variety of chemicals with varying degrees of destructivenes to fire fighting foam bubbles. It includes fuels like MTBE (Methyl Tertiary Butyl Ether) commonly used in Unleaded Gasoline, which is mildly foam destructive, industrial alcohols like Methanol, Esters and Ketones, to severely foam destructive solvents like Acetone and Propylene Oxide.

Applying water alone to these hazards simply does not work. Attempting to extinguish by dilution is no solution at all, as it bulks up the flaming liquid, which burns more ferociously and quickly overflows the containment areas. This sends a flaming river of polar solvent into other previously unaffected areas, escalating the incident and making it much harder to control and extinguish. Conventional hydrocarbon type foams are little better as the bubbles collapse instantly on contact with the solvent as it extracts the water from the establishing foam blanket.

SPECIAL AR FOAMS REQUIRED

Special AR type foams (AR-FFFP or AR-AFFF) are required to extinguish polar solvent hazards as they have a special mechanism that protects the water in the foam from being attacked by the polar solvent fuel.

Virtually all of these AR-AFFF and AR-FFFP type foams contain a water-soluble polymer which is deposited in a thin layer in each foam bubble. Once the first foam bubbles come into contact with the polar solvent fuel these bubbles are initially attacked in a similar way to standard foams, but they leave their polymer behind as an impenetrable polymer "life-raft" or "skin" across the fuel surface allowing a stable foam blanket to build up above. If the blanket should get broken or disturbed for any reason then the polymer raft is self-repairing from the polymer laid down by the next bubbles above the point at which disturbance appears.

INDUCTION DIFFICULTIES WITH POLYMERS

Some AR foam concentrates suffer from having so much polymer that they are highly viscous and difficult to induce accurately, especially in winter conditions. The polymer makes them pseudoplastic or shear thinning. This means that energy is required to make them move when they thin down and once moving they will flow reasonably well, but they do generally have a very short memory and quickly revert back to being thick, once the energy input ceases. To this extent they are similar to tomato ketchup or non-drip paint!

They also get more difficult to move as the ambient temperature drops and much below freezing many quickly become unusable. Those that contain special anti-freezing agents struggle to induce accurately.

Another potential problem with this type of foam concentrate is that the water-soluble polymer can be forced out of solution into a jellified mass in the drum or tank during storage. This is most widespread with those products with high polymer levels and therefore being thicker than the others. It may just be evaporation of the water content in the foam concentrate that de-stabilises the polymer, or it may be exposure to freezing and thawing. Experience shows that being frozen and thawed out three times is enough to send many foam brands into a state of polymer separation. If this happens they cannot be re-mixed so the concentrate is useless and must be replaced. The best of these products will last for in excess of 10 years when stored properly, but the worst can separate in a matter of months!

POLYMER-FREE OPTION

A novel new AR type product that solves these problems is called Niagara. It does not suffer these viscosity problems as it is totally polymer-free and is therefore as fluid as the conventional hydrocarbon type foams. Even down to –18°C it cannot suffer polymer separation as there is no polymer present to separate!

CARBONACEOUS MATERIALS

Class A fires are normally controlled and extinguished effectively with water alone. However there are some carbonaceous hazards where water tends to run off like plastic and pine needles, so some foams specialise in reducing the surface tension of water to give it better penetrating characteristics. Such products are often called "wetting agents" or "wet water". These products are used in tiny amounts with water on a wide range of carbonaceous materials from paper, cardboard, textiles and upholstery to plastics, cabling, even forestry, heathland and hay stores, to maximise water penetration,

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cooling and steam inerting. As a result the fire is generally extinguished faster with less water damage, less water usage, less fire water run-off and less run-off to contain and therefore less likelihood of major pollution of the environment.

WHICH FOAM TYPE TO CHOOSE?

To determine this we need to understand the strengths and weaknesses of each foam type. To help do this there are 10 key assessment criteria to consider when choosing the best foam type for your applications.

FOAM ASSESSMENT CRITERIA BY FOAM TYPE

In order to distinguish between the strengths and weaknesses of different foam types (irrespective of brand name), we need to determine the key criteria to make this assessment. It is clear that foam assessment can no longer be done on fire performance alone as there are other equally important associated factors that need to be considered, like environmental impact and ease of induction.

6 KEY FIRE PERFORMANCE FACTORS

1. speed knockdown
2. minimised fuel pick-up
3. resistance to heat
4. sealing against hot metal
5. resists flashbacks
6. protecting against re-ignition

4 Key Associated Factors

1. storage characteristics
2. viscosity and ease of induction
3. environmental impact
4. multi-purpose applications

(non-aspirated, Low Expansion, Medium Expansion, High Expansion, Hydrocarbons, Polar Solvents, Class A)

Essentially the **more "stars" the better**, but to assist reading this table the stars are also colour coded:

Red * = POOR performance,
Blue * = AVERAGE performance
Green* = GOOD performance

Columns in yellow define synthetic detergent based products that risk emulsifying hydrocarbons and carrying them into the environment. Those in green define natural protein based products that do not emulsify hydrocarbons and offer minimal environmental impact.

In fire performance terms we need to look at induction and storage stability and increasingly environmental considerations as well.

The table opposite will help to clarify this for you – the more stars the better!

This will focus your attention on the key criteria to ensure the correct choice is made.

There are 7 foam types used on Class B fires. The wetting agents commonly used on Class A fires are almost exclusively in the SD category, a few are in the AFFF category and the polymer free AR-FFFP can also be used effectively at 0.2-0.6% for wetting applications on Class A foams and 0.6-1% for compressed air foam systems.

WHAT INDUCTION RATE SHOULD YOU CHOOSE?

For each foam type there are several induction rate grades available. A common misconception is that a 6% foam is the strongest, but in fact it is the weakest concentrate because you have to add more of it to water to get the same result, ie. 94 parts of water to 6 parts of foam. A 1% concentrate is strongest as one needs just 1 part of concentrate to 99 parts of water.

6% FOR AVIATION

In the past the 6% foams were generally a little more fluid than the 3% foams which still holds true for the Protein and Fluoro-Protein foams which contain no film forming agents. Consequently the aviation, military and marine sectors tended to select 6% in preference for their use as they needed a fluid foam to achieve the fastest knockdown. This is now changing and more users are moving to 3% concentrates to make better use of the space on their fire trucks as a smaller and lighter foam tank is required.

3% FOR OIL AND PETROCHEMICALS

The 3% foams were more frequently used in the Oil and Petrochemical industries as their requirements were for a slightly stiffer foam to resist radiant heat better and showed a preference for 3% concentrates. Since they also usually required larger quantities of foam it was easier to store less of a more concentrated foam and also more practical from a logisitical standpoint when it was being used on large fires. A 1,000 litre bulk container of 3% lasts twice as long as one of 6% foam and is generally more cost effective than 2,000 litres of 6% grade of the same foam concentrate.

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KEY FOAM ASSESSMENT CRITERIA

Foam type	SD	P	FP	AFFF	FFFP	AR-AFFF	AR-FFFP	Polymer free AR-FFFP
Main Applications	**Hi Ex**	**Training**	**Tanks & Bunds**	**Aviation**	**Aviation**	**Multi-purpose**	**Multi-purpose**	**Multi-purpose**
Knockdown	***	*	***	*****	*****	****	****	*****
Fuel Pick-up	*	*	*****	**	****	***	****	*****
Resists heat	*	*****	*****	**	****	***	*****	****
Edge sealing	*	***	*****	**	****	***	****	*****
Flash risk low	*	***	*****	**	*****	***	*****	*****
Resists Re-ignition	*	**	*****	***	****	****	*****	****
Storage	*****	****	****	*****	*****	***	****	*****
Multi-use	5	3	3	5	4	5	5	6
Ease induction	*****	*****	*****	*****	*****	***	***	*****
Minimal Env. impact	*	***	****	**	****	***	****	****
TOTAL "stars"	24	30	44	32	43	34	44	48

International standards require foam proportioning systems to achieve 3-4% induction across the range of operating conditions which is easily and reliably achieved by most competent foam proportioning equipment. A 3% foam system running a little lean or rich (by say 0.5%) from the proportioning system will have little impact on the fire performance of the system. It should still work and have sufficient foam to apply to put the fire out. 3% foam concentrates are remarkably tolerant of such proportioning fluctuations and are therefore the most popular and widely used grade of foam concentrate.

1% FOR OFFSHORE PLATFORMS

1% grades are not available in all foams types. Only AFFFs and AR type foams are available in 1% grades and are considerably more expensive than 3% grades. The internationally accepted tolerances are also much tighter at just 1-1.25%. These 1% foams were originally embraced as the answer to lower weight loadings on offshore platforms some years ago, but the problems of maintaining the required levels of accuracy in terms of foam induction systems and storage tank volumes has caused some to revert back to 3% grades for better reliability and minimal environmental impact with FFFPs.

1% concentrates are very strong but are intolerant of proportioning fluctuations. If the proportioning system should run a little lean (as above we said 0.5%) then you are only getting half the intended foam mixed into the water supply to make foam and there is a real risk that the fire may not be adequately controlled or extinguished. On the other hand if this same system ran a little rich (by say 0.5%) then you are adding 50% more foam every minute than intended and the foam concentrate supply could run out – hopefully after you have achieved fire control but possibly before you have fully extinguished the fire, leading to potentially disastrous burnbacks. At worst, once the foam runs out, water alone could then be delivered onto the fire, which could cause dangerous flare-ups and potentially major re-involvement.

What does 1-3, 3-3 and 3-6 mean?

These terms are used for the multi-purpose AR type foams, where the first digit refers to

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the induction or proportioning rate to be used on hydrocarbon fuels and the second digit refers to the induction rate to be used on the more aggressive polar solvent fuels. These are sometimes also referred to as 1x3, 3x3, or 3x6 concentrates.

1X3 AR FOAMS A FALSE ECONOMY

Multi-purpose AR type foams are already more expensive than conventional standard foams for hydrocarbon hazards as they are capable of doing a much more complicated and versatile job. However one should recall that by their nature they are relatively thick concentrates with high polymer levels, making induction more difficult to achieve at any grade than the equivalent standard foam concentrate. This is especially the case for 1x3 products, which are used at just 1% on hydrocarbons and 3% on polar solvents. The only real exception when a 1-3 foam could be sensibly considered is when that AR foam has no thick polymer present.

At 1% induction it is vitally important to achieve adequate proportioning in your system in all climatic conditions to achieve effective fire protection. Most of these AR-type polymer containing foams are not suitable for use below +1.7°C. At these low temperatures AR foam induction at 3% is a challenge for most portable inductors or fixed foam proportioning systems. When the claimed induction rate is reduced further to 1% it becomes very difficult to maintain induction of these shear-thinning polymeric foams to effective levels so you should be planning some additional contingency volume in your storage tanks! The comments from using 1% concentrates (above) become even more relevant. It is also still possible to get the setting wrong which could potentially put the safety of firefighters at risk by exposing them to unnecessarily weak foam solutions on a more severe polar solvent hazard.

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3X6 AR FOAMS CAN CONFUSE

For foam users with only a small inventory of polar solvents and majority of hydrocarbons on site, these foams are ideal. Proportioned at just 3% for hydrocarbon usage, there are often fixed systems designed for use at 6% on the polar solvents so little confusion is likely. However many Municipal Fire Departments have been using 3-6 foams only to find their fire vehicles are often set on the wrong foam setting when they respond to a fire and someone has to remember to reset it before foam is applied to the hazard. If just 3% is applied to a polar solvent then the foam will not work correctly and the firefighters safety could inadvertently be put at risk. Alternatively if left on 6% when responding to a hydrocarbon incident, twice as much foam could be used as necessary, which is wasteful and could mean the foam tank empties before the fire is brought under control.

THE SIMPLE ANSWER IS 3-3 AR FOAMS

Increasing numbers of AR foam users are now moving to choose 3-3 foams as these foams are proportioned at 3% on both hydrocarbons and polar solvent fuels so there is no need to keep re-setting propotioning settings and one can never get it wrong and potentially put colleagues lives at risk.

By selecting a 3-3 AR foam the foam user cannot get the proportioning setting wrong thereby putting colleagues potentially at risk and it can mean cost savings on foam usage and foam equipment as only a single 3% setting is required. Foam is not wasted by incorrect settings and it increases the fire power of the existing foam tank as it will provide a foam supply for twice as long on polar solvent fires as it would using a 3x6 AR foam!

CONCLUSIONS

We have investigated the hazards for which foams are most widely used, the strengths and weakness of different foam types (highlighting those most suited to specific applications) and the grades available for different induction options.

WIDE DIFFERENCES IN FOAM TYPES

It is important to remember that within any specific foam type there are wide differences in terms of fire performance and environmental impact between specific branded products. Reputable manufacturers offer products that have independent approvals. The key ones to look for are UL listings to the UL 162 standard from Underwriters Laboratories Inc. in USA. UL also acts as the foam users "policeman" on foams that are listed, as samples are taken at random several times per year from the market and manufacturer's premises to verify that the formulation has not changed from when it was first approved. Other important independent approvals are independent witness certification to the International Civil Aviation Organization's standard for Level A or Level B type foams, the LASTFIRE test independently witnessed and certified by the LASTFIRE Co-ordinator, and batch certification to major international standards like the recently introduced European EN 1568 standard.

CONDUCT MANUFACTURER AUDIT

It is also important to do a manufacturer/supplier audit of those supplying the product to check what service levels are being offered. You need one with technical and research expertise to keep you informed of topical issues and generate new developments. You need a manufacturer who can test your foam and verify that as it ages you know when it is reaching the end of its life and needs replacing.

You also need a manufacturer with an active 365 day, 24 hour emergency foam service that can supply you with additional foam should you be unfortunate enough to have a major incident and require more high performance foam urgently. You should also be wary of buying very cheap products, as with all things you get what you pay for! Your own and your colleagues safety may be riding on your particular choice.

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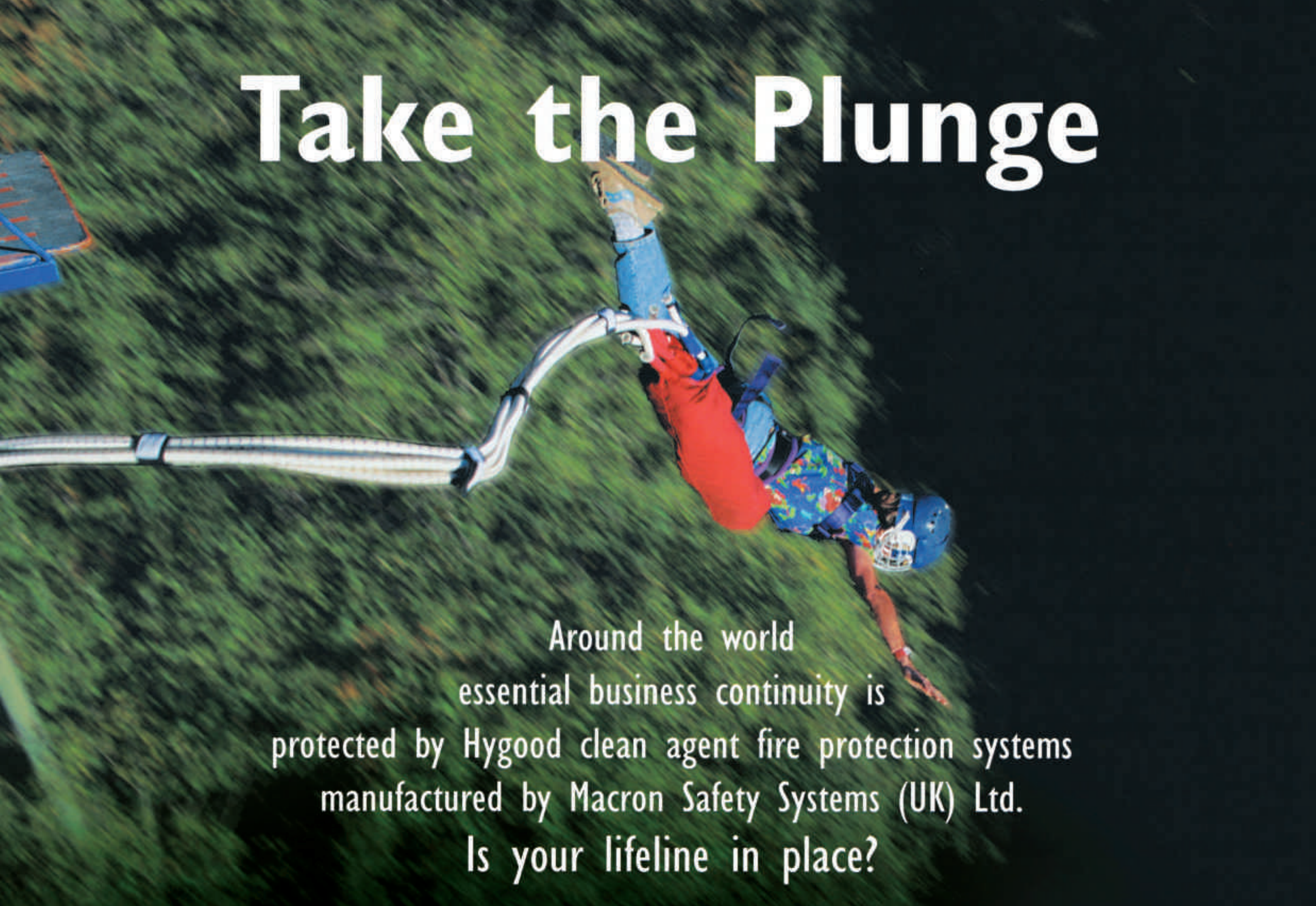

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Communication Center Fire Protection

By Ralph E. Transue, P.E.
Rolf Jensen & Associates, Inc.
The RJA Group, Inc., Chicago, IL, USA
Chair, NFPA International, Technical
Committee on Telecommunications

Pic courtesy of RJA Group

COMMUNICATION CENTERS take many forms. Common characteristics include great reliance on electronic equipment and few people. People present are not the general public. They are people with knowledge and purpose, familiar with the center and its mission.

MISSION

Missions of communications centers include telecommunications, public safety communications, process control, data transfer, financial transactions, dispatching, broadcasting, security monitoring, asset protection, satellite links, transmission of military and business information, and monitoring of campuses, military bases and building complexes.

Mission continuity in such facilities requires protection against the threat of fire.

BEST PRACTICES

Telecommunications facilities throughout the world benefit from the best facilities and practices that the local economy can support. Societies recognize the importance of communications for personal, civil, business, and military effectiveness. Governments or service providers apply practices including conforming to building codes and fire prevention regulations, good house keeping, limiting storage of combustibles, fire resistive construction, secure facilities, compartmentalizing buildings and providing redundancy in network facilities. These practices have resulted in an outstanding fire loss record in hundreds of thousands of square meters of communication center floor space worldwide over many years, despite several high profile exceptions in the latter half of the twentieth century. One effort to capture best practices used in North America has been the publication of NFPA 76 – Recommended Practice for the Fire Protection of Telecommunications Facilities, intended to provide a reasonable level of network protection and safety to life from the threat of fire. It is a performance-based document and also includes prescriptive recommendations as alternatives to the performance-based approach. Developed using a consensus method by a balanced committee of experts from the U.S. and Canada, the committee is currently improving the recommended practice document further to be proposed for adoption as a standard.

FIRE & SMOKE

Fire threat to electronic equipment can originate in the equipment itself or external to the equipment. Fire history shows that communication center and electronic data processing fire damage have resulted from electrical power circuits, electronic equipment, normal combustibles and house keeping causes, and as a result of exposure from fire in other facilities.

Fires threaten people in the building, the mission of the facility and property.

Smoke, corrosive products of combustion, threatens the operability and repair ability of electronic equipment even as it may threaten human life. The early stage of fire development is likely to produce smoke, especially when electronic equipment or cable insulation is involved.

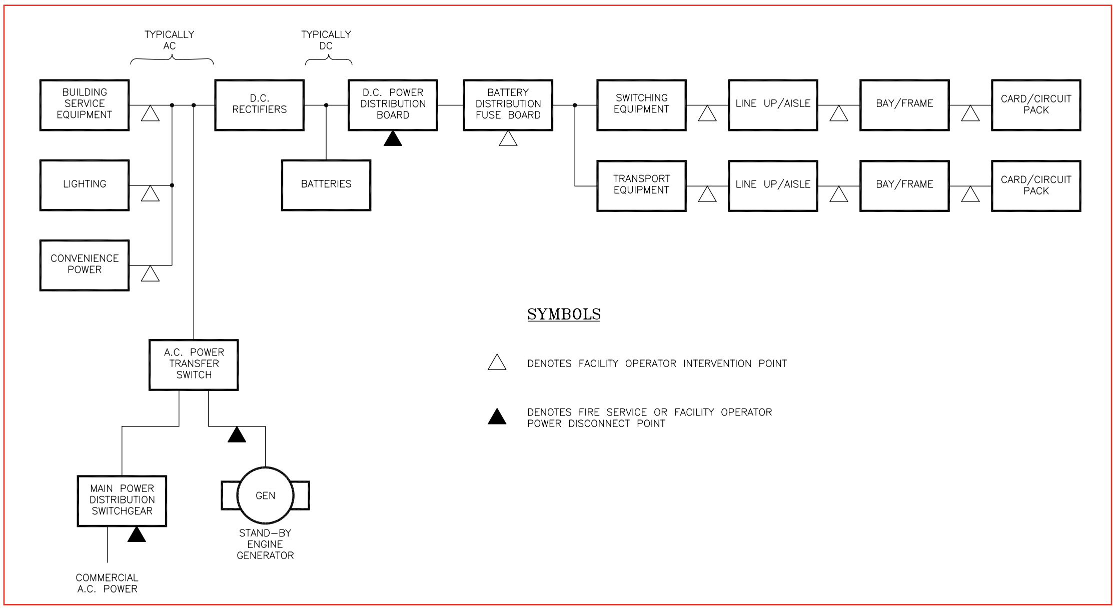
Early warning smoke detection methods can alert people to the need to investigate the source. Intervention to reduce or eliminate the threat to people and the mission of the facility is the first goal. That intervention may occur at a point of component overload or very small fire involving normal combustibles, prior to any threat beyond the point of origin, using very early warning smoke detection systems.

Successful human intervention requires effective processing of the alert signal and timely response by one or more knowledgeable person. Terminating the incident by extinguishing a small fire, removing an overloaded circuit board or removing power to a circuit or equipment frame may occur before any automatic fire suppression system would release its agent.

In some cases, a means to extract or manage smoke is recommended to prevent corrosive damage to equipment not otherwise affected by the fire. The mission of the facility is dependent upon the prevention of corrosive smoke and water damage to electronic equipment.

FIRE RESISTANT EQUIPMENT

After some large loss fires affected the U.S. telecommunications network in the 1960s and 1970s, the industry developed standards that include requirements to limit fire growth in equipment, wire and cable used within telecommunications facilities. Equipment procurement specifications for most of the telecommunications equipment and cable installed in U.S. and Canadian telecommunications facilities require conformance to the fire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resistance standards. This practice has been successful in limiting the size of equipment fires that have occurred since.

The same cannot be said for data processing and information technology equipment used for more general purposes that does not meet the requirements of the fire resistance standards. Nor would it apply to telecommunications equipment and cable designed and manufactured to other standards.

Methods used in the design and manufacture of equipment and cables to conform to the standards result in greater production of smoke but lesser and slower fire spread in the event of a fire. This North American approach has resulted in an excellent record of preventing electronic equipment malfunctions from becoming major fires. Combined with the excellent fire service response throughout most populated areas in the U.S. and Canada, this fire resistance approach lessens the need for automatic fire suppression in telecommunications equipment spaces.

Fire protection for equipment and facilities that do not include the equipment and cable fire resistance is more challenging. A performance-based analysis is recommended.

FIRE THREAT ASSESSMENT

Fire threat assessments of facilities can identify the levels of conformance with good fire prevention practices, fire separations, equipment and cable standards, and the types of threats or hazards present in or adjacent to the facility.

Threat assessments for communication centers should be performed on a space-by-space basis. Larger facilities are separated into spaces that conform to functional uses of the spaces. Each type of space presents hazards or characteristics associated with the use and contents of the space. It is not recommended that communications centers be treated as a single occupancy. For fire protection, the characteristics of spaces vary greatly, not only in contents but also in the level of criticality to the mission of the facility.

Once having become familiar with the communications center and the characteristics of its spaces, it is advisable to understand the mission of the facility and the level of importance or criticality of the spaces to accomplishing the mission. Lacking the information on relative importance, it may be necessary to treat the entire facility as critical to the mission. Alternatively, it may be acceptable to treat electronic equipment and power spaces as more critical to the communication mission than administrative and support spaces.

Wherever a critical functional use of equipment occupies the same space as a less critical functional use, the space must be treated at the higher level of criticality.

SOLUTIONS

No single solution is best for every configuration of communication center.

Communication centers may be grouped into types that have common characteristics and by sizes, but it is the services provided by the center and the customers served by the center that determine the criticality of the facility.

Methods of protection and levels of performance that are necessary for continuity of service against fire should be determined by the center's mission and customers served, more so than its physical characteristics. Stakeholders must decide what performance levels are required for network protection. Designers and installers must achieve and verify that performance using passive and active fire protection systems. Facility operators must maintain the fire protection systems for the life of the center to protect network operations and provide safety to life and property.

INTEGRATED FIRE PROTECTION SYSTEMS RESPONSE

Passive and active fire protection systems work together to achieve required performance.

Passive Systems

- Begin with risk reduction. Owners and operators should apply resources to achieve lesser frequency and severity of fire incidents.
- Progress to rigorous fire prevention practices. Comply with regulations. Control hazards.
- Comply with building codes. Use fire resistive construction. Use containment and maintain compartment integrity.
- Create awareness. Inform occupants and responders.
- Secure the center against unauthorized entry and external threats.
- Plan, document and train for emergency response.

Active Systems

Fire Detection

In the most critical functional areas, the optimum first choice where responders are available and trained, is the combination of:

- Very early warning fire detection alert and alarm.
- Rigorous alert and alarm processing.
- Rapid response by trained people.

The goal is to terminate the incident before it becomes a growing fire.

Some losses have occurred where the detection system performed properly, but failure occurred in processing the signal to responders or the responders were not positioned to respond quickly.

AUTOMATIC SUPPRESSION

Automatic suppression systems should be used with care. Used where fire resistive equipment or construction is not present or is not adequate. Used where adequate alarm processing and rapid response cannot be achieved. Used with care because risk of damage, downtime and cleanup accompanies the discharge of any fire suppression agent on energized electronic equipment.

It is understood that fire suppression agents that are corrosive must not be used on electronic equipment.

Considering the use of automatic fire sprinkler systems and clean agent systems, a summary guide is as follows:

- Automatic sprinkler systems are best suited to protection of
  - the structure.
  - storage spaces.
  - cable entrance spaces.
  - non-equipment spaces.
- Clean agent systems are best suited to protection of electronic equipment spaces.

The discharge of water in the presence of electronic equipment can be destructive to the equipment. More so when the equipment is energize.

A fire must be very active to produce the significant temperature rise necessary for actuation of automatic fire sprinklers. In the presence of electronic component failures or small fires that may occur in equipment spaces, automatic sprinkler systems do not activate. If an equipment space fire should grow to a heat release rate great enough to activate the sprinkler system, products of combustion would combine with water spray and elevated humidity to produce corrosive acids which will attack the connections in the electronic equipment. By that time, severe equipment damage will occur.

SMOKE MANAGEMENT

An alternative approach to automatic suppression, to protect the equipment against smoke damage early in a fire incident, is smoke extraction or management. That is not a statement that smoke management is equivalent to fire suppression – it is not.

Where equipment spaces are very large or very critical, and the performance required of the active and passive systems is to protect equipment from smoke in the equipment space, smoke management can perform up to limits. A system to remove smoke high in the space with make-up air introduced low in the space can keep the corrosive products of combustion above equipment that is not directly exposed to the fire. Such systems must be carefully designed and maintained.

This approach must be combined with rapid fire service response. The clear air introduced into the space aids fire service response. Fire service operations must be such that suppression is swift and involves minimal area of attack to avoid equipment damage. Studies have shown this method with well-informed fire service and communications center staff provides greater service continuity than the automatic sprinkler system solution.

The limitation to the smoke management solution in lieu of the automatic sprinkler solution is that a growing fire will eventually produce more energy than the smoke management system can handle. By that time, severe equipment damage will occur.

It is the partnership between the fire service and communications center staff for early detection, rigorous alarm processing, activation of smoke extraction systems and rapid response that makes the smoke management approach successful.

POWER DISCONNECT

One method of intervention for electrical fires or overloads of any size is to disconnect power – sometimes described as powering-down or de-powering. The committee that is continuing the development of NFPA 76 plans to include de-powering requirements or recommendations in the 2005 edition.

It is not unusual for the fire service to request or cause disconnect of power to any building involved in fire attack.

Communications centers are unique in that de-powering the facility:

- Is difficult due to several levels of power redundancy.
- Interrupts services provided by the facility.
- Causes critical missions to fail.

Pic courtesy of RJA Group

For communication center electrical overloads or fires, the optimum de-powering approach is to remove power from the smallest segment of the power distribution system that is necessary to de-energize the equipment or cable involved in the fire. This requires knowledge of the power system and is best done by communications center trained staff. Alternatively, a program of familiarization between the center operator and the fire service may provide the fire service with sufficient knowledge to perform some of the power disconnecting functions even without the operator's personnel. Figure 1 (left) illustrates points in the power distribution system where facility operators and fire service can disconnect power in a communication center, based on the traditional North American central office power arrangement.

Selective de-powering requires marking the operating equipment and the power disconnecting means associated with the operating equipment. A means to direct the fire service to the location of the disconnecting means may also be necessary.

EXPOSURE

Electronic equipment spaces and the building systems and facilities that support the operating equipment can be damaged by exposure to external fire threats. Such threats may be from other spaces within the communication center or from property owned and operated by others.

Protection against such exposure requires adequate separation and fire suppression for the non-communication center space to prevent the spread of fire and smoke into the communication center.

If a communication center is to be located in a multiple tenant building, the building selected should be of fire resistive construction with an automatic suppression system throughout the non-communication center space.

In rural and suburban areas, plantings and natural growth should be cleared away from the communication center. Air intake openings should be located high and away from outside sources of smoke or other contaminants.

SPECTRUM OF SOLUTIONS

Much information is available from suppliers of passive and active products and systems. Each has a potential place in protecting the mission of communication centers; continuity of service.

To maximize continuity of critical communication services against the threat of fire

- Assess and minimize the risks.
- Determine protection performance levels required.
- Match cost-effective, integrated passive and active systems to performance goals.
- Maintain long-term performance of systems.
- Plan, document, and practice.

For references see:

"Fire Protection of Telecommunications Facilities," *Fire Protection Handbook,* 19th ed., vol.2, ed. Arthur E. Cote (Quincy, Mass.: National Fire Protection Association, Inc., 2003), 267-277.

Mr. Ralph E. Transue is a Senior Vice President with The RJA Group, Inc. Located in the company's global headquarters in Chicago, IL USA, Mr. Transue has extensive experience in designing fire protection systems for communication centers. He currently serves as Chair for NFPA International's Technical Committee on Telecommunications. To learn more about The RJA Group visit their website at www.rjagroup.com.

PPV FAN: MARKET GUIDE

FSI NORTH AMERICA

Model Number	PGB18-4H/4HO	PGB21-4H/4HO	PGB24-4H/4HO	PGB24-6H/HO	PEB18-1	PEB21-1	PEB24-1
Product Name	Fantraxx				PEB18-4	PEB21-4	PEB24-4
Origin	Canada				exp. proof	exp. proof	exp. Proof
Size of Fan	18”	21”	24”	24”	18”	21”	24”
Third Party Air-Flow Certification	AMCA 16,447 CFM	AMCA 17,321 CFM	AMCA 19,555 CFM	AMCA 20,478 CFM	AMCA 9,440 CFM	AMCA 12,803 CFM	AMCA 15,875 CFM
Power Source	Honda	Honda	Honda	Honda	Leeson	Leeson	Leeson
Engine Size	5.5 HP	5.5 HP	5.5 HP	6.5 HP	1 HP	1.5 HP	2 HP
Material Used	steel	steel	steel	steel	steel	steel	steel
Weight	86 lbs.	88 lbs.	95 lbs.	98 lbs.	76 lbs.	92 lbs.	105 lbs.
Delivery Times	4 weeks	4 weeks	4 weeks	4 weeks	4 weeks/ex proof 8 weeks		
Unique Features	heavier gauge steel, all stainless steel full axles and ball bearings, all pneumatic tires, higher CFM Third party certified on a per size basis, competitive price – all avail. in metric and 50/60 Hz, 115/230V to all world/country standards as needed.						
Warranty	1 year	1 year	1 year	1 year	1 year	1 year	1 year

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E-mail: markconron@fsinorth.com
Website: www.fsinorth.com

GROUPE-LEADER

Model Number	MT236	MT445	MT260	MT296
Product Name	MT236 – Leader	MT445 – Leader	MT260 – Leader	MT296 – Leader
Origin	France	France	France	France
Size of Fan	16”	22”	22”	22”
Third Party Air-Flow Certification	AMCA: 17 525 CFM ULH (University of Le Havre) 21,000 CFM	AMCA: 17 605 CFM ULH (University of Le Havre) 26,000 CFM	ULH (University of Le Havre) 35,000 CFM	ULH (University of Le Havre) 56,000 CFM
Power Source	Vanguard (Briggs)	Vanguard (Briggs)	Vanguard (Briggs)	Vanguard (Briggs)
Engine Size	6 HP	6 HP	9 HP	18 HP
Material Used	Resin, Steel, Epoxy Coated	Resin, Steel, Epoxy Coated	Resin, Steel, Epoxy Coated	Resin, Steel, Epoxy Coated
Weight	37.5 Kg	43 Kg	59.5 Kg	68.5 Kg
Delivery Times	3	6	3	6
Unique Features	4 Stroke Engine / Compact, easily stowed in any locker of a vehicle / Portable, easy to handle, stable / Very easy to set up / No1 in Europe	4 Stroke Engine / Compact, easily stowed in any locker of a vehicle / Portable, easy to handle, stable / Very easy to set up / No1 in Europe	4 Stroke Engine / Compact, easily stowed in any locker of a vehicle / Portable, easy to handle, stable / Very easy to set up / No1 in Europe	4 Stroke Engine / Compact, easily stowed in any locker of a vehicle / Portable, easy to handle, stable / Very easy to set up / No1 in Europe
Warranty	2 Years	2 Years	2 Years	2 Years

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Website: www.groupe-leader.com

HALE EUROPE

Model Number	21W10	30W22	18H5	21H5	24H5	27T10
Product Name	Water turbine driven fan	Water turbine driven fan	Petrol engine driven fan	Petrol engine driven fan	Petrol engine driven fan	Petrol engine driven fan
Origin	UK	UK	UK	UK	UK	UK
Size of Fan	533mm / 21”	762mm / 30”	457mm / 18”	533mm / 21”	610mm / 24”	686mm / 27”
Third Party Air-Flow Certification	AMCA240 21,280 CFM	AMCA240 45,650 CFM	AMCA240 13,350 CFM	AMCA240 18,800 CFM	AMCA240 20,400 CFM	AMCA240 30,030 CFM
Power Source	Pressurised water	Pressurised water	Honda engine	Honda engine	Honda engine	Tecumseh engine
Engine Size	10 HP	22 HP	5.5 HP	5.5 HP	5.5 HP	10 HP
Material Used	Aluminium and thermoplastic	Aluminium and thermoplastic	Stainless steel and thermoplastic	Stainless steel and thermoplastic	Stainless steel and thermoplastic	Stainless steel and thermoplastic
Weight	16 Kg	40 Kg	38 Kg	41 Kg	43 Kg	53 Kg
Delivery Times	6-8 weeks	6-8 weeks	6-8 weeks	6-8 weeks	6-8 weeks	6-8 weeks
Unique Features	Misting feature	Misting feature	Retractable handle, tilting mechanism, wheels	Retractable handle, tilting mechanism, wheels	Retractable handle, tilting mechanism, wheels	Retractable handle, tilting mechanism, wheels
Warranty	12 months from date of commissioning	12 months from date of commissioning	12 months from date of commissioning	12 months from date of commissioning	12 months from date of commissioning	12 months from date of commissioning

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RUSSWURM VENTILATOREN GmbH

Model Number	301907
Product Name	VM 600 ex
Origin	Germany
Size of Fan	600 mm
Third Party Air-Flow Certification	DIN 24166
Power Source	Electric
Engine Size	2,5 kW
Material Used	Aluminium
Weight	52 Kg
Delivery Times	2-3 days
Unique Features	spark-proof
Warranty	2 years

SUPER VAC

Model Number	718G4-T	718G4-H	720G4-H	724WT	724G4-H
Product Name	PPV Fan	PPV Fan	PPV Fan	PPV Fan	PPV Fan
Origin	USA	USA	USA	USA	USA
Size of Fan	18"	18"	20"	24"	24"
Third Party Air-Flow Certification	15350 CFM AMCA	15590 CFM AMCA	18580 CFM AMCA	22470 CFM AMCA	20920 CFM AMCA
Power Source	Gas	Gas	Gas	Water	Gas
Engine Size	Tec 6.0 HP	Honda 6.5 HP	Honda 6.5 HP	Pok 12 Hp	Honda 9.0 HP
Material Used	Alum/Stl	Alum/Stl	Alum/Stl	Alum/Stl	Alum/Stl
Weight	36 Kg	37 Kg	42 Kg	40 Kg	61 Kg
Delivery Times	3 weeks	3 weeks	3 weeks	5 weeks	3 weeks
Unique Features	Rear Tires	Rear Tires	Tilt Hand	Tilt Hand	Rear Tires
Warranty	5 year	5 year	5 year	5 year	5 year

SUPER VAC cont.

Model Number	730G4-H	7.20E+04	720EXP	720VS2	GP164S
Product Name	PPV Fan	PPV Fan	PPV Fan	PPV Fan	PPV/NPV
Origin	USA	USA	USA	USA	USA
Size of Fan	30"	20"	20"	20"	16"
Third Party Air-Flow Certification	26730 CFM AMCA	10190 CFM AMCA	10190 CFM AMCA	14060 CFM AMCA	9250 CFM AMCA
Power Source	Gas	Electric	Electric	Electric	Gas
Engine Size	Honda 13 HP	Std. 1 HP	Haz 1 HP	Var 1 HP	Honda 4.0 HP
Material Used	Alum/Stl	Alum/Stl	Alum/Stl	Alum/Stl	Alum/Stl
Weight	74 Kg	42 Kg	46 Kg	41 Kg	25 Kg
Delivery Times	5 weeks	3 weeks	4 weeks	5 weeks	5 weeks
Unique Features	Largest	Rear Tires	Haz Loc	Variable	Duct
Warranty	5 year	5 year	5 year	5 year	5 year

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PPV FAN: MARKET GUIDE

TEMPEST TECHNOLOGY

Model Number	BD 27-H-13	BD 21-T-5.5	DD 21-H-6.5	DD 16-H-5.5	EB 16-VSM
Product Name	27" Belt Driven Honda	21" Belt Drive Tecumseh	21" Direct Drive Honda	16" Direct Drive Honda	16" Variable Speed Electric
Origin	USA	USA	USA	USA	USA
Size of Fan	686mm (27") Diameter	534mm (21") Diameter	534mm (21") Diameter	406mm (16") Diameter	406mm (16") Diameter
Third Party Air-Flow Certification	40,703 m^3/hr (23,943 CFM) per AMCA 240-96	31,745 m^3/hr (18,673 CFM per AMCA 240-96	34,258 m^3/hr (20,152 CFM) per AMCA 240-96	20,414 m^3/hr (12,008 CFM) per AMCA 240-96	18,105 m^3/hr (10,650 CFM) per AMCA 240-96
Power Source	Petrol Engine	Petrol Engine	Petrol Engine	Petrol Engine	Electric Motor
Engine Size	13 HP	5.5 HP	6.5 HP	5.5 HP	1 HP
Material Used	Spun Aluminum shroud, tubular steel frame, fibreglass reinforced nylon blade	Spun Aluminum shroud, tubular steel frame, fibreglass reinforced nylon blade	Spun Aluminum shroud, tubular steel frame, fibreglass reinforced nylon blade	Spun Aluminum shroud, tubular steel frame, fibreglass reinforced nylon blade	Spun Aluminum shroud, tubular steel frame, fibreglass reinforced nylon blade
Weight	70 Kg	39 Kg	36 Kg	30 Kg	21 Kg
Delivery Times	2-4 weeks	2-4 weeks	2-4 weeks	2-4 weeks	2-4 weeks
Unique Features	The most powerful compartment PPV blower available. A foot-operated tilt mechanism and a retractable handle	The most popular PPV blower in the world. A foot-operated tilt mechanism and a retractable handle	The most powerful 21" PPV blower available. A foot-operated tilt mechanism and a retractable handle	Ideal for small compartments. A foot-operated tilt mechanism and a retractable handle	Variable speed up to 3,200 rpm. A foot-operated tilt mechanism and a retractable handle
Warranty	5 yrs - Blower / 2 yrs - Honda Engine	5 yrs - Blower / 2 yrs - Tecumseh Engine	5 yrs - Blower / 2 yrs - Honda Engine	5 yrs - Blower / 2 yrs - Honda Engine	5 yrs - Blower / 1 yr - Electric Motor

TEMPEST TECHNOLOGY cont.

Model Number	EB 21-VSF	EBS-16	DD 21-W-5.5	MVU 48	MVU 60
Product Name	16" Variable Speed Electric	16" Electric Smoke Ejector	21" Water Drive	48" Mobile Ventilation Unit	60" Mobile Ventilation Unit
Origin	USA	USA	USA	USA	USA
Size of Fan	406mm (16") Diameter	406mm (16") Diameter	534mm (21") Diameter	1,250mm (48") Diameter	1,525mm (60") Diameter
Third Party Air-Flow Certification	26,404 m^3/hr (15,532 CFM) per AMCA 240-96	5,440 m^3/hr (3,200 CFM) per AMCA 240-96	30,175 m^3/hr (17,750 CFM) per AMCA 240-96	136,000 m^3/hr (80,000 CFM) per AMCA 240-96	200,000 m^3/hr (118,000 CFM) per AMCA 240-96
Power Source	Electric Motor	Electric Motor	Water Turbine	Diesel engine powering hydraulics	Diesel engine powering hydraulics
Engine Size	1 HP	1/3 HP	5.5 HP	129 HP	129 HP
Material Used	Spun Aluminum shroud, tubular steel frame, fibreglass reinforced nylon blade	All Steel housing, fibreglass reinforced nylon blade	Spun Aluminum shroud, tubular steel frame, fibreglass reinforced nylon blade	Steel Shroud, Steel Frame, Aluminum Fan Blade	Steel Shroud, Steel Frame, Aluminum Fan Blade
Weight	33 Kg	21 Kg	30 Kg	4,000 Kg	6,000 Kg
Delivery Times	2-4 weeks	2-4 weeks	2-4 weeks	4-6 months	4-6 months
Unique Features	The most powerful 21" electric blower available. Variable speed up to 2,400 rpm. A foot-operated tilt mechanism and a retractable handle	The only smoke ejector that features a fibregalss reinforced nylon blade for better negative pressure ventilation performance	A foot-operated tilt mechanism and a retractable handle	A scissors lift, rotation system and tilt mechanism to adjust the air pattern. Able to ventilate road tunnels, subway systems and aircraft	The most powerful PPV Fan in the world. A scissors lift, rotation system and tilt mechanism to adjust air pattern. Able to ventilate road tunnels, subway systems and aircraft
Warranty	5 yrs - Blower / 1 yr - Electric Motor	5 yrs - Blower / 1 yr - Electric Motor	5 yrs - Blower / 1 yr - Water Motor	5 yrs - Blower / 2 yrs - Diesel Engine	5 yrs - Blower / 2 yrs - Diesel Engine

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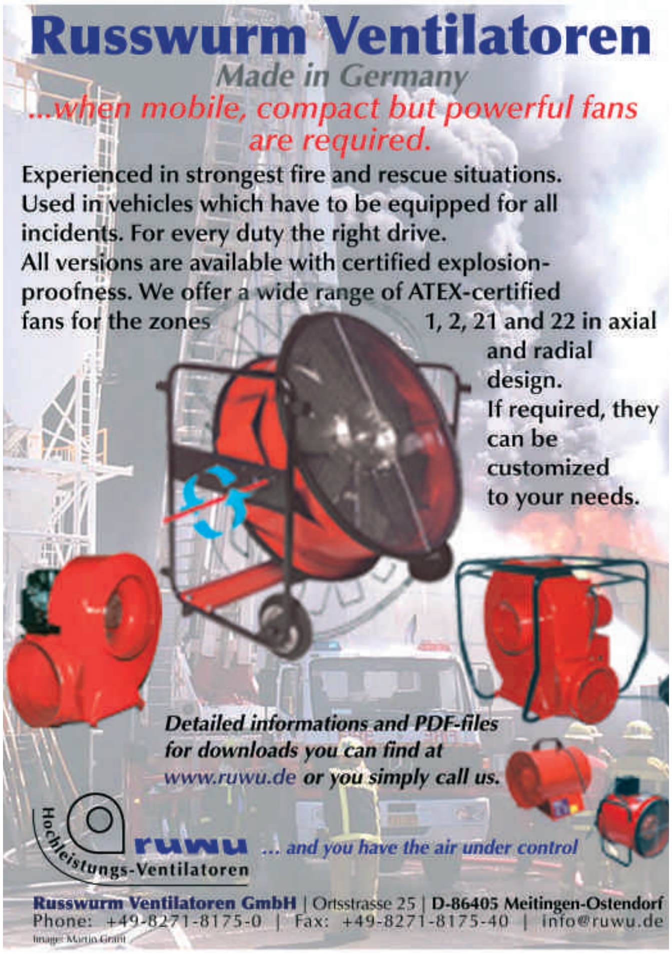

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Image: Martin Grant

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PPV FAN: MARKET GUIDE

UNIFIRE POWER BLOWERS

Model Number	**DST-3P4**	**DSTS-3P4-5**	**DST-3P4-6.5**	**DST-9P4**	**DST-13**
Product Name	**DST-3P4**	**DSTS-3P4-5**	**DST-3P4-6.5**	**DST-9P4**	**DST-13**
Origin	Spokane, WA USA	Spokane, WA USA	Spokane, WA USA	Spokane, WA USA	Spokane, WA USA
Size of Fan	18" - 4 Blade	18" - 2 Blade	20" - 4 Blade	20" - 4 Blade	24" - 4 Blade
Third Party Air-Flow Certification	14,885 CFM	14,800 CFM	17,000 CFM	17,500 CFM	22,000 CFM
Power Source	Gas	Gas	Gas	Gas	Gas
Engine Size	5.5 HP	5 HP	6.5 HP	9 HP	13 HP
Material Used	Stainless Steel, Unitron Blade	Stainless Steel, Unitron Blade	Stainless Steel, Unitron Blade	Stainless Steel, Unitron Blade	Stainless Steel, Unitron Blade
Weight	81 lbs.	78 lbs.	91 lbs.	111 lbs.	139 lbs.
Delivery Times	2 weeks	2 weeks	2 weeks	2 weeks	2 weeks
Unique Features	8" Off Road Pneumatic Wheels & extendable 35" handle	8" Off Road Pneumatic Wheels & extendable 35" handle	8" Off Road Pneumatic Wheels & extendable 35" handle	8" Off Road Pneumatic Wheels & extendable 35" handle	8" Off Road Pneumatic Wheels & extendable 35" handle
Warranty	Propeller: Limited Lifetime Frame: 5 Year Limited Warranty Engine: 2 Year Factory Warranty	Propeller: Limited Lifetime Frame: 5 Year Limited Warranty Engine: 2 Year Factory Warranty	Propeller: Limited Lifetime Frame: 5 Year Limited Warranty Engine: 2 Year Factory Warranty	Propeller: Limited Lifetime Frame: 5 Year Limited Warranty Engine: 2 Year Factory Warranty	Propeller: Limited Lifetime Frame: 5 Year Limited Warranty Engine: 2 Year Factory Warranty

UNIFIRE POWER BLOWERS cont.

Model Number	**E18SP**	**E18P4**	**EB18SP**	**EX18SP**	**FFHDST-3P4**
Product Name	**E18SP**	**E18P4**	**EB18SP**	**EX18SP**	**FFHDST-3P4**
Origin	Spokane, WA USA	Spokane, WA USA	Spokane, WA USA	Spokane, WA USA	Spokane, WA USA
Size of Fan	18" - 2 Blade	18" - 4 blade	18" - 2 Blade	18" - 2 Blade	18" - 4 Blade
Third Party Air-Flow Certification	12,000 CFM	15,500 CFM	12,000 CFM	12,000 CFM	14,885 CFM
Power Source	Electric	Electric	Electric	Electric	Diesel
Engine Size	2 HP	5 HP	1.25 HP	2 HP	4.7 HP
Material Used	Stainless Steel, Unitron Blade	Stainless Steel, Unitron Blade	Stainless Steel, Unitron Blade	Stainless Steel, Unitron Blade	Stainless Steel, Unitron Blade
Weight	85 lbs.	88 lbs.	90 lbs.	110 lbs.	109 lbs.
Delivery Times	2 weeks	2 weeks	2 weeks	2 weeks	2 weeks
Unique Features	Non-Variable, Standard On/Off, Available in any of our frame styles, comes in DS frame unless otherwise specified	Non-Variable, Standard On/Off, comes in DS frame unless otherwise specified	Variable Speed, Available in any of our frame styles, comes in DS frame unless otherwise specified	Explosion Proof, Available in any of our frame styles, comes in DS frame unless otherwise specified	8" Off Road Pneumatic Wheels & extendable 35" handle
Warranty	Propeller: Limited Lifetime Frame: 5 Year Limited Warranty	Propeller: Limited Lifetime Frame: 5 Year Limited Warranty	Propeller: Limited Lifetime Frame: 5 Year Limited Warranty	Propeller: Limited Lifetime Frame: 5 Year Limited	Propeller: Limited Lifetime Frame: 5 year warranty on frame Engine: 2 year factory

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Website: www.unifireusa.com

WEBER-HYDRAULIK RESCUE TOOLS

WEBER-HYDRAULIK is one of the world's largest and leading manufacturer's of hydraulic rescue tools. The tools were first produced in 1974.

In both Austria and Germany the company is the clear market leader for rescue equipment. The main customers in both countries are the volunteer fire brigades, with a high proportion of the professional, industrial, and airport fire brigades, also committed WEBER-HYDRAULIK users, as are the civil defence authorities.

WEBER-HYDRAULIK holds a very strong market position in European Countries. In the Middle East and Far East, and particularly Japan, strong inroads have been made into the market in recent years. WEBER-HYDRAULIK rescue equipment has also achieved a remarkable penetration in the USA since it was introduced in 1994.

The global success of Weber-Hydraulik owes a great deal to the lightweight and well-balanced design of the equipment it supplies, allowing the highest levels of performance to be achieved.

Continuous research and development, and the use of new materials, enables WEBER-HYDRAULIK to produce tools which perfectly meet the demands of users like fire brigades, military, disaster response services, and police. All our tools are tested according to DIN 14751 Germany, NFPA 1936 USA, and prEN 13204 Europe.

WEBER-HYDRAULIK has been successfully assessed to the ISO 9001 quality standard for the design, production and marketing of its hydraulic rescue tools.

Rescue operations require 100% commitment from both the Rescuer and the Tools. By working closely with leading vehicle manufacturers, and fire brigades, we at WEBER-HYDRAULIK ensure that our rescue systems can tackle the most arduous task.

The advancement of new vehicle materials has placed new demands on rescue tools. In addition to conventional steel, new vehicle technology is equipped with the latest high strength alloy steel, aluminium, and plastic sections.

For example, extremely strong materials are in the A-columns of convertible cars. The protection systems employed in modern vehicles require higher cutting and spreading forces, as well as innovative blade design. Our close working relationship with leading vehicle manufacturers ensures that rescue personal are equipped with tools able to cope with the latest materials. With advancement of our products it is possible to fulfil all requirements.

One of the most popular pieces of equipment developed for the new car technology is the Super-Vario Combination Tool SPS 400. This combination tool has a fully adjustable or removable handle. Both the speed, and power, of the SPS 400 can be controlled by pressing the push-button knob; which is a unique control for fine-tuned precision handling.

This Super-Vario sets new standards for combination tools:

- Opening 425 mm
- Highest cutting class according to prEN
- Spreading forces equivalent to heavy duty spreaders
- Tips detachable for unrestricted cutting

The hydraulic pressure required to supply the tool is provided by the V 50 Compact Simultaneous Power Unit. This unit has two options, either operating both tools simultaneously at standard speed, or the operator's selected tool on double speed "TURBO" operation. Very compact, and with a large oil tank, it is becoming the first choice for both combination and heavy rescue kits.

WEBER-HYDRAULIK rescue tools are fully compatible with other manufacturers' high-pressure systems. When ordering, customers simply have to state the make of coupling required, which is supplied at no additional cost, and enables our customers to integrate high rescue kits without having to consider complete replacement.

Throughout the World, on a daily basis, WEBER-HYDRAULIK equipment meets the challenge in Rescue and Emergency situations.

In October 2003, WEBER-HYDRAULIK introduced, for the first time in Europe, the "Rescue Days". This large event was divided into three theory/classroom presentations, and eight practical workshops. Over 130 participants, mainly from Germany, the Netherlands, Switzerland, Austria, Luxembourg, and Italy, attended the two-day event, and all were given the opportunity to put their rescue skills to the test on the very latest production cars, in addition to tackling complex rescue scenarios.

WEBER-HYDRAULIK is developing special training programmes with some of the World's leading fire brigades.

For further information,
please contact:
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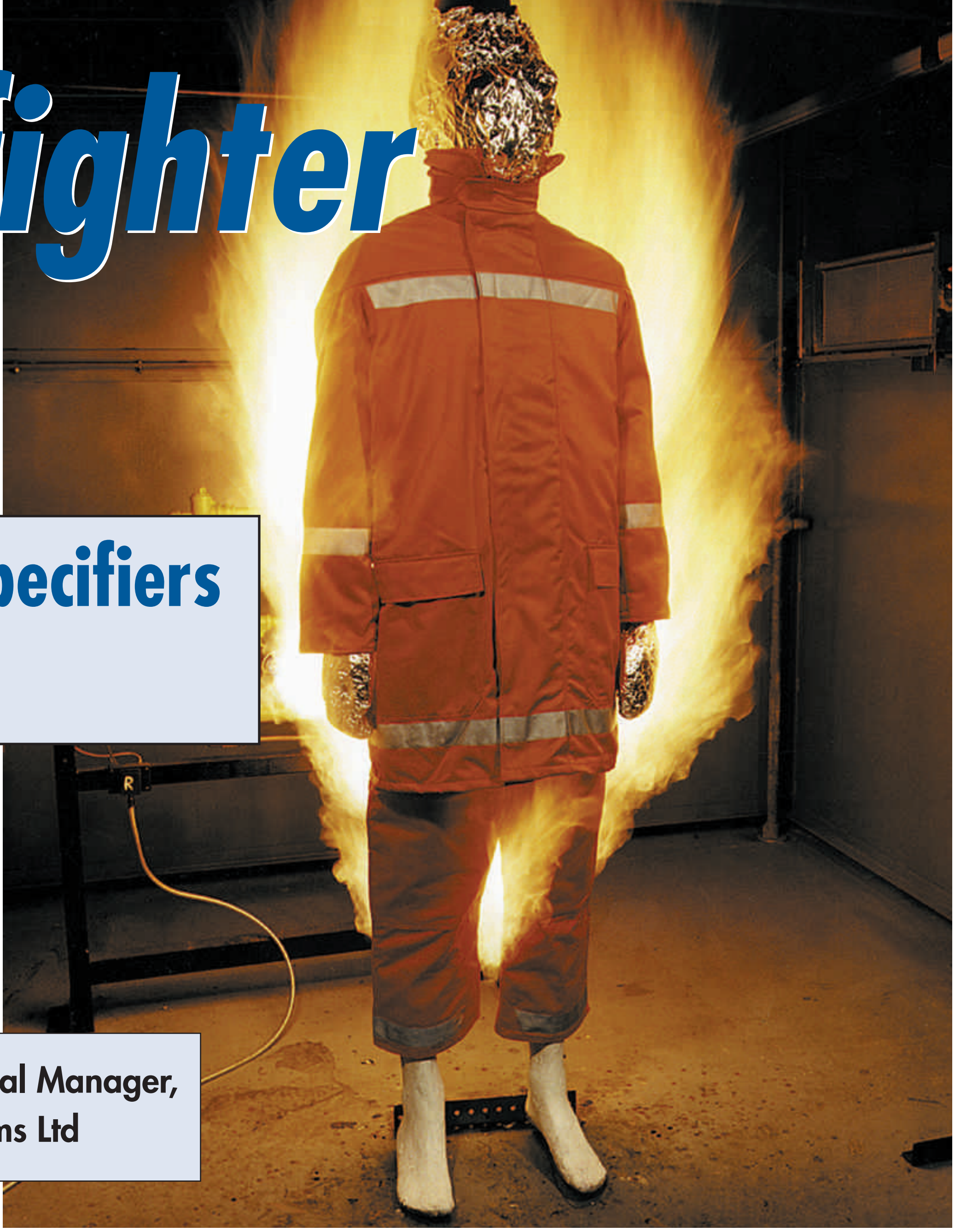
Firefighter PPE

Buyers/Specifiers Guide



By Ivan Rich, Technical Manager,
Bristol Uniforms Ltd

WITH AN EVER-INCREASING range of hazards to which firefighters can be exposed, the correct specification of protective equipment is essential to ensure their consistent and comprehensive safety and security. A full understanding and appreciation of the varied conditions which the firefighter may face in the diverse operational environments to which the emergency services are required to respond is essential if their personal safety is not to be compromised.

Extensive guidelines are now available to any employer engaging the services of professional firefighters to help them understand the hazards to which firefighters may be exposed, assess the risks involved and select the protective clothing essential to ensuring the operational safety of their employees – safety which is clearly designated *their* responsibility. This now means that the selection of PPE not only involves fitness for purpose but its lifetime performance to measurable standards of protection.

PD CEN/TR 14560:2003 is the definitive document which sets out guidelines for the "selection, use, care and maintenance of protective clothing against heat and flame" and was published in June 2003.

This Standard sets out to look at all aspects of PPE which are now essential areas of responsibility for specifiers and buyers of personal protective equipment, in particular clothing, and to provide a summary of the key issues to be considered.

In broad terms, deployment of firefighters in both public sector and private industrial environments places a responsibility on employers to carry out a thorough assessment of the operational conditions under which those firefighters can, and will, be expected to work. This includes . . .

- A comprehensive risk assessment
- A detailed definition of the level of protection required
- Familiarisation of the alternative types of protective clothing available
- Undertaking wearer trials
- Obtaining any further supporting test data which would assist decision making

Buyer decision-making must now go beyond this stage into an understanding and appreciation of the conditions under which the PPE will be used and will require the buyer to consider additional points including:

- User training in the conditions under which the garments can be safely used and limitations on their performance

- Appropriate record keeping to provide adequate management information
- The importance of routine PPE examination and inspection
- The evaluation and monitoring of protective clothing performance in service

A third, and critically important, area of responsibility concerns the ongoing care and maintenance of all PPE. It is the responsibility of the manufacturer to ensure that comprehensive care instructions are provided with all garments to allow the employer to put in place a care and maintenance programme, which ensures the continued performance of all PPE to the required standards. This will include the need for appropriate measures for . . .

- Cleaning
- Decontamination
- Storage

. . . as well as maintenance which will include . . .

- Inspection and inspection criteria
- Repairs
- Removal of garments from service and the criteria for such decisions
- Safe disposal

The responsibilities now placed on employers are such that it is incumbent on them not only to **fully understand and appreciate the extent of these responsibilities** but also **how to discharge them effectively.** To assist in this process it is important to look at each of the areas in more detail.

Selection

Selection is a process, which seeks to match the performance of the garment to the hazards to which it will be exposed requiring a thorough risk assessment. This will include . . .

- An identification of the wearer's activities
- An understanding of the complete range of potential hazards likely to be encountered
- Risk quantification

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- An assessment of the level of protection required from the PPE taking into account other extraneous conditions likely to be present in firefighting conditions

To match protective garments to the wearer it is important to appreciate the need for garments to be fully compatible and that each provides the required level of body protection under any operational conditions. To this end buyers should ensure that any potential supplier can provide a comprehensive sizing service as well as wearer trials to ensure compatibility, comfort and good fit. The style and cut of fire coats and trousers will need to be considered carefully in conjunction with their use alongside helmets, hoods, boots and gloves.

Once the available options have been considered, the selection process to determine which manufacturer's PPE is best suited to the identified needs of the user should then consider . . .

- Are the garments manufactured under carefully controlled conditions (does the manufacturer have internationally recognised quality assurance accreditation e.g. the appropriate ISO certification?)
- Do the garments meet the necessary performance standards as set out in the appropriate PPE directives and are they independently certified as such? (Directive 89/686/EEC)
- Does the manufacturer use component materials (outer layer, moisture barrier and thermal protection) in clothing, which are independently assessed and certified in their own right?
- Does the manufacturer submit garments for type testing in simulated fire tests or other recognised independent laboratory assessment programmes to evaluate performance after washing, decontamination or UV exposure as well as abrasion resistance and chemical repellency?

Given the close co-operation required between supplier and buyer to arrive at well drawn up specifications, other considerations, which will be important in ensuring a satisfactory long-term relationship will include . . .

- The provision of appropriate user/wearer training (will this be undertaken directly by the manufacturer or will it be contracted out to a third party and how will this be effectively monitored and quality controlled?)
- The provision of a comprehensive after sales service and long term maintenance plan (this is discussed in greater detail under *Lifetime Care*)
- An agreement on a mutually satisfactory garment delivery time from order for both standard and special sizes
- Stockholding arrangements for emergency or unexpected short-term demands (whose responsibility will this be or is it a shared one and how will this be organised to ensure that availability is not compromised?)

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PPE in use

Once PPE comes into operational use, the emphasis shifts to the employer who must adopt procedures which ensure that all garments for which they now have responsibility are worn and looked after correctly.

Before garments are put into active service the first requirement will be to set up and implement a training programme to satisfy European Directive 89/656/EEC (section II, article 4 para 8). It is important at this stage for supplier and user to understand and appraise the wearer of the capabilities as well as the limitations of the garments being brought into use. In particular this will include training on:

- What hazards will be protected against and which won't
- The effects of long-term exposure on the garments
- The proper use of the PPE
- Complying with supplier's instructions on use, storage, cleaning, conditions of exposure, which might render the garment unwearable, repair, replacement, and eventual removal from use and disposal.

In service, all garments need to be monitored regularly to ensure that they continue to meet performance criteria. This will necessitate the use of effective records to allow comprehensive management information systems to be adopted. Record keeping should enable a full life history of each item of PPE from manufacture to disposal. Records should be detailed enough to include for each individual item:

- A manufacturer's specification
- A service history
- Training records
- Cleaning history
- Maintenance and repair history

Wearers should be trained to undertake their own regular kit inspections to check for soiling, contamination, physical and thermal damage and to inspect for any missing accessories such as reflective trim, which might compromise safety.

Lifetime Care

An integral part of the European Directive 89/686/EEC is a requirement that the manufacturer supply full care and

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maintenance instructions. These must be clearly stated on permanent labels affixed to each garment and should also be available in the form of a users guide or handbook for reference purposes.

It is the buyer's/owner's responsibility to ensure that a suitable programme of garment care is put in place. This can be an in-house capability or can be delegated to a qualified third party or the manufacturer. Given the specialised knowledge and equipment required to undertake the comprehensive care and maintenance schedule to the required standards, it is becoming increasingly common for fire services to buy in the expertise rather than divert scarce resources to handling it themselves.

Manufacturers are in many respects best equipped to handle the care of PPE as they have an intimate technical understanding of the materials and fabrics involved and the expertise to inspect for damage and test for performance reductions brought about by exposure to fire and water and physical damage. In particular, requirements include the ability to determine . . .

- What cleaning methods are appropriate, including decontamination?
- When should garments be cleaned?
- Is it appropriate for inspection and care to be carried out to a pre-planned a scheduled or on ad hoc basis?
- Who will carry this out and how will any re-application of finishes or fabric treatments be undertaken, if required?
- How and where will garments not in use be stored?
- Good and appropriate cleaning practice

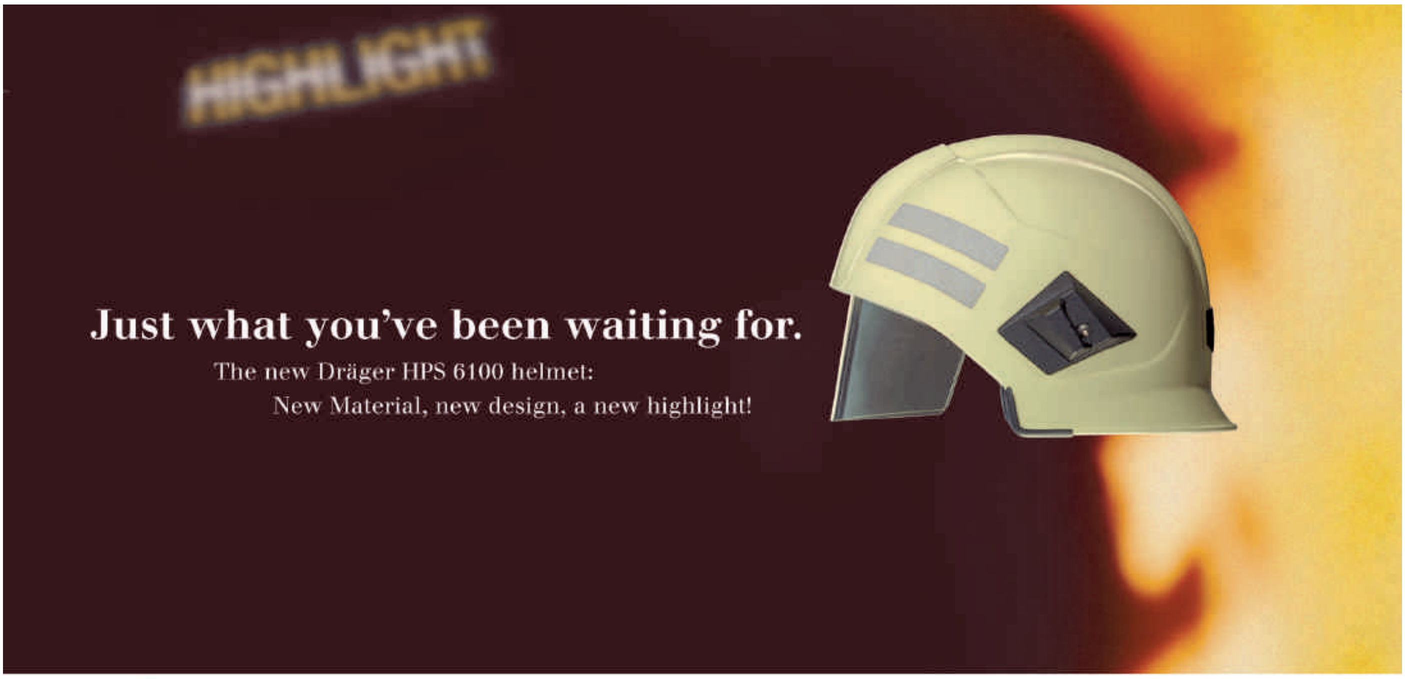
Special attention needs to be paid to decontamination to ensure that this is undertaken effectively and safely and to ensure that cross-contamination does not occur.

When deciding whether or not to contract the lifetime care and maintenance to the manufacturer there are a number of issues to be considered including . . .

- The level of service offered and its reliability
- The degree of flexibility provided (collection and delivery of garments, any on-site facilities where required etc)
- Are the services provided directly by the manufacturer or are they hired in from a third party and how might this affect quality control and service delivery?
- The opportunity cost of contracting out
- Overall value for money

Given the important health and safety implications for the wearer and the strict codes of accountability placed on the employer it is evident that the selection and use of PPE in the fire service has far wider implications than ever before. With ever-greater emphasis now being placed on the health and safety of the wearer, employers and leading manufacturers are now actively looking into the design and development of garments, which also take into account the effects of heat stress from prolonged use of PPE. Attention, and the prescribed standards, have hitherto focused on the impact of, and need for protection from, external hazards. It is now increasingly recognised that the wearers own body heat and fluid emissions can be significant health and safety factors under operational conditions. Selection of PPE in the future will increasingly focus on identifying garment constructions, which not only meet the required external protection requirements but also minimise the potential for fatigue and heat stress problems.

Ivan joined Bristol Uniforms in 1981 and as Technical Manager for the Company is responsible for ensuring relevant accreditation to the European standard EN 469 for Bristol Uniforms' products and to NFPA 1971 (2000) edition. He has an extensive knowledge of Standards and technical requirements relating to fabrics.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Visual warning devices

By John Rattlidge
E2S – European Safety Systems

VISUAL SIGNALLING DEVICES, often referred to as strobes or beacons, are used extensively in emergency systems to alert people of danger, to indicate that a hazard is present or that a predefined condition has been detected. A primary rule is that a visual signal shall normally only be used in an emergency system as a reinforcement to an audible warning device, although they are, of course, widely used by themselves in industry to indicate machine state or environmental condition.

Operating technologies – strengths and weaknesses

ROTATING BEACONS

Using either a tungsten or halogen bulb, or more recently an LED 'bulb', a parabolic reflector, driven by an electric motor, rotates around the light source on a vertical axis creating a powerful beam of light travelling through 360°. However, because of vibration, harsh conditions and extremes of temperature, these electro-mechanical units usually have a relatively short life; the current consumption of the bulb and motor is also high, making them relatively unattractive for most applications.

E2S Type L101 beacon, 5 Joule version for general alarm indication

FILAMENT BULB

Control circuitry enables a blinking output to be achieved. Indicators using a filament bulb normally use a Fresnel lens to enhance the light output, giving adequate performance at a relatively low cost. Filament bulbs have quite a short life, further shortened when exposed to quite low levels of vibration. In general, a filament bulb beacon is of limited effectiveness and should normally be used only as an indicator rather than as an alarm beacon. It is the least expensive option and units are available in a wide range of physical dimensions, wattages and enclosure styles.

XENON (STROBE) TUBE

Operating at very high voltage generated by an inverter circuit, the Xenon gas in the tube breaks down, creating an instantaneous brilliant flash of light, normally enhanced by using a 'Fresnel' lens. The light energy of the flash is a function of the Xenon tube size, the voltage across it and the capacity of the capacitor discharging into it. The Xenon strobe beacon has the best light output to power input ratio and is the most widely used and versatile technology currently available. Tube life is critical: it may be as little as 1 million flashes in cheaper devices but specifiers should typically expect 5 to 8 million flashes from higher quality units.

LED (LIGHT EMITTING DIODE)

A semiconductor device, unlike the filament bulb and the Xenon tube emits only one frequency of light (i.e. one colour). LED technology is rapidly developing and while it does not as yet offer as bright an output as the Xenon tube, it does offer an extremely low current and very long life time, giving an effective solution where an indication or status is required. Once a quirky and expensive alternative, the emergence of ultra bright LEDs means the LED beacon has become a viable low current consumption, zero maintenance alternative to the Xenon strobe. It is particularly effective in Intrinsically Safe areas, where the necessary power input restrictions do not allow a Xenon strobe to function at anything like peak efficiency.

Locating an alarm strobe beacon

Light travels in straight lines, so the beacon will be far more effective if positioned in the line of sight rather than relying on reflections. Where applicable, audible signals should always be the primary warning with the beacon used as a secondary alarm indication or status, generally the audible and visual indicators should be located close together. All round light dispersion should be the first consideration when installing a beacon; ensuring free air movement to prevent the build up of excessive heat is also important and beacons should never be installed upside down. Wherever possible, vibration should be avoided.

Some larger types of Xenon beacon

E2S Type BEx 15 Joule, auto synchronised beacon, Explosion Proof for hazardous locations

in emergency systems

emit the light from the side rather than the top of the enclosure, so if wall mounted with the lens 90° to the wall as shown in figure 1, most of the effective light will be emitted up to the ceiling and down to the floor. Such devices should either be mounted directly to a horizontal surface (figure 2), or on a horizontal bracket from a wall, figure 3.

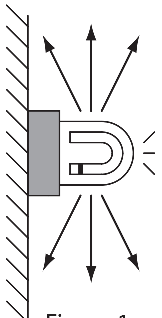
Figure 1

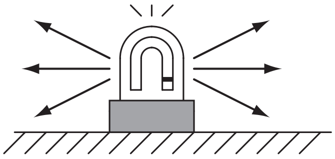
Figure 2

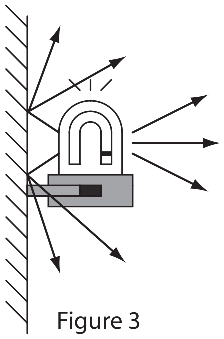
Figure 3

The beacon should be installed so as to ensure that the maximum light output is emitted over the desired area of coverage. The effective area of a beacon is a function of the Xenon tube shape – either straight or, more usually, horse-shoe-shaped as shown above – and the mounting angle of the lens.

Beacon effectiveness and range

Xenon beacon manufacturers specify performance in a number of ways: probably the most common being Joules, a measure of the incident energy applied to the beacon tube. More meaningful is the peak and average output light emission measured in candela. “Brightness”, often presented as polar plots is often used for more accurate, involved calculations and coverage predictions; it is referred to within product standards.

The perceived brightness of a beacon is dependent on the brightness of the light source, the lens colour of the unit and the ambient light level. A general indication of the effective 360° coverage for Xenon beacons with clear lens covers, installed in an industrial environment, is shown in figure 4. The inner circle defines the alarm distance where an observer’s attention would be attracted if he was not looking in the general direction of the beacon; the outer circle the indication distance where an observer would be unlikely to see the emitted light if he was not looking in the general direction of the beacon.

The effect of lens colour on the perceived intensity of the light source within an industrial environment is quite significant (figure 5).

Finally, as a rule of thumb, the intensity of a beacon is reduced by 25% as the viewing distance is doubled.

Please note all the above information is for guidance only and does NOT guarantee performance or coverage.

Environmental conditions influencing beacon selection

HAZARDOUS AREA USE

Intrinsically Safe Xenon tube strobes are of limited effectiveness due to the energy restrictions required by the intrinsically safe protection method; they are therefore little more than an indicator in most applications. The performance of Ultra Bright LEDs available to the beacon manufacturer means that Intrinsically Safe LED beacons are increasingly becoming the preferred choice, giving longer life, higher output and improved reliability than Xenon tube alternatives.

AMBIENT LIGHT LEVEL

In all applications, the worst case ambient light level must be considered and an effective beacon installed. The safety of people may well depend on the beacon’s performance and the responsible designer and installer will ensure that the beacon is sufficiently powerful and that it is installed in a suitable location. The worst that can be done is simply installing the least expensive and most ineffective model because the regulations or standards simply demand ‘a beacon’.

INGRESS PROTECTION/IP RATING

Most manufacturers offer high IP66 and IP67 rated beacons within their range. Be careful of over-specifying the degree of protection required; check the environmental requirements carefully.

ELECTRICAL CONSIDERATIONS

Rotating beacons, though effective, require high current; in many cases, a Xenon strobe or LED beacon will be a more attractive alternative. If the beacon is going to be controlled via a PLC (Programmable Logic Controller), then high inrush currents can generate induced transients, interfering with the PLC. A fully suppressed product will dramatically reduce the likelihood of such problems, particularly in multi beacon applications.

MECHANICAL CONSIDERATIONS

Is a lens guard required to protect against impact? Can the beacon be installed so that the observer will

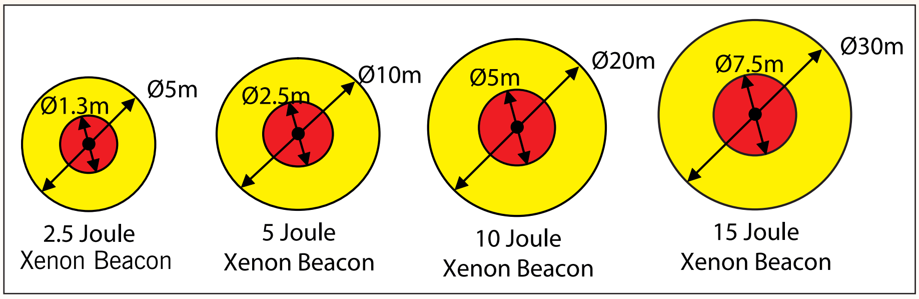

Figure 4

Light Source	Lens Colour	Clear	Yellow	Amber	Red	Blue	Green
Xenon	–	100%	93%	70%	23%	24%	25%
Filament	–	100%	95%	70%	17%	17%	12%

Figure 5

directly see the light output rather than reflections? Does the manufacturer supply suitable brackets to enable the optimum installation to be achieved?

SERVICEABILITY

A dirty beacon is ineffective; many faulty beacons dramatically start working again once a fully qualified, competent person has wiped them over with a damp cloth! However, if access for routine cleaning, particularly in a dirty environment, is difficult, the performance of the beacon will inevitably degrade with time.

LEDs have the longest life, second are Xenon tubes, and last are filament and halogen bulbs. Premature failures, particularly in filament bulbs, are often the result of mechanical vibration and shock. Some beacon manufacturers offer replacement Xenon tubes; normally it is sensible to replace the associated circuitry at the same time. Whichever light source is used, it should be protected and restrained in order to minimise the effects of vibration and thus offer the longest life in commercial and industrial applications. The mechanical design of the unit is another area where the low cost manufacturer will skimp, with predictably deleterious effects on reliability.

E2S Type L101L-IS beacon, Intrinsically Safe, ultra bright LED Array for Zone 0, 1 & 2 applications

Standards and Approvals relating to visual signalling devices

There are many different standards either referring in whole or part to visual signals and beacons; the ones below cover industrial, fire and evacuation applications.

USA/Canada

UL 1638 Visual Signal Appliances

Requirements include electrical safety, endurance and environmental tests, light output and dispersal tests; the specification distinguishes between fire alarm use and non-fire alarm general signalling use in both indoor and outdoor environments.

UL 1971 Signalling Devices for the Hearing Impaired

Adds minimum levels of light and dispersal within sleeping and non sleeping areas and synchronised flashing of visual signals within a fire alarm or evacuation system to the requirements of UL 1638.

Europe

A draft standard for beacons under the EN 54 series, equivalent to EN 54-3, Fire Detection and Fire Alarm Systems – Audible Fire Alarm Devices, will set out minimum environmental requirements and a means of defining the beacon manufacturer's declaration of output and performance.

United Kingdom

PFEER, the Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations.

These regulations state the person or company responsible for an installation is also responsible for protecting persons on the installation from fire and explosion and securing effective emergency response.

International

IEC 73 – Colours of luminous indicators & push buttons

This standard sets out the colours required to conform to the machine directive.

E2S Type MB010, 10 Joule beacon IP67 & IP66 protected for harsh and exposed conditions

- **RED – Danger, Act Now.**
  - ○ Danger of live or unguarded moving machinery or essential equipment in protected area.
- **AMBER – Warning, Proceed with Care**
  - ○ Temperature or pressure different from normal level
- **GREEN – Safety Precaution: Go Ahead**
  - ○ Checks complete, machine about to start
- **BLUE – Site Specified**
  - ○ Pre-set ready or remote control
- **CLEAR – No specific Meaning**
  - ○ Could confirm and earlier message

Marine industry

IMO – International Maritime Organisation Resolution A.686 (17), Code on Alarms and Indicators

Intended to provide general design guidance and to promote uniformity of type, location and priority for those alarms and indicators that are required by the 1974 SOLAS convention. The code applies to shipboard alarms and indicators on ships constructed on or after 1st July 1992 and on major modifications or new installations after this date.

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How to select a nozzle

By Mark Saner, Director of Product Development for the Akron Brass Company

THE PURCHASE of your fire fighting nozzles is one of the most important purchases a fire brigade must make. Without the right nozzle the rest of the water delivery system is of little value, because the nozzle is what gets the right amount of water, in the right form, in the right place.

So how do you make the best selection possible? There are a number of decisions that need to be made based on the application for which the nozzle is to be used. These decisions can be broken down into three main categories 1. Type 2. Size 3. Brand. By evaluating these categories you will be able to narrow your selection to type, size and brand that best suits your needs. We will now go into more detail about each of these three categories.

TYPE

There are five basic types of nozzles and you need to select the right type for your application. The five types are:

1. **Solid Bore** – A solid stream nozzle with an unobstructed waterway of various sizes. Typically used at pressures between 3.5 and 5.5 bar.
2. **Fixed Orifice** – A combination adjustable spray and straight jet nozzle with a fixed orifice set for a specific flow at a specific pressure.
3. **Adjustable Orifice** – A combination adjustable spray and straight jet nozzle with the ability to adjust to multiple flow settings while flowing.
4. **Constant Pressure/Automatic** – A combination adjustable spray and straight jet nozzle that constantly adjusts the flow to maintain a relatively constant nozzle pressure, usually 7 bar.
5. **Multi-purpose/Combination Solid Bore and Fixed Orifice** – A nozzle that allows you to select between a fully adjustable spray nozzle and a true solid bore nozzle.

When trying to select the type of nozzle for your brigade you should look at the application for which it is to be used. Various nozzles are better suited for various applications. It is also helpful to look at the advantages and disadvantages of each type to determine which type is right for you. The charts below indicate some typical applications and the nozzle types that are best suited and the advantages and disadvantages of the various types.

SIZE

When selecting the proper size of nozzle, you need to look at both the

Application	Nozzle types
Interior (unvented/reduced steam)	Solid/Multi
Interior (vented/steam desired)	Fixed/Adjustable/Automatic/Multi
Exterior (reach and penetration)	Solid/Multi
Cooling	Fixed/Adjustable/Automatic/Multi
High Flow/Low Pressure*	Solid/Fixed/Adjustable/Multi
Low Flow/High Pressure**	Fixed/Adjustable
Foam Application	Fixed/Adjustable/Automatic/Multi
Compressed Air Foam (CAFS)	Solid/Multi

*Possible high flow/low pressure applications include high rise, low pressure hydrants, reduced manpower, and long hose lays.

**Possible low flow/high pressure applications include interior water mist pulsing and low water supply.

Picture courtesy of Akron Brass Company

Picture courtesy of Akron Brass Company

volume of water or foam you want to apply, the capability of the delivery system you will be using (hose) and the manpower handling the nozzle. There is often a debate over the flow required for a given fire so you will need to determine the flow rate you want. The hose size and manpower you will be using will to some degree dictate the maximum flow you can achieve. The following chart gives you typical flow rates and minimum fire fighters typically associated with specific hose sizes.

One or more of these three variables (hose size, flow range, or fire fighters) will dictate the size of nozzle you will need. For example if you are using

Type	Advantages	Disadvantages
Solid Bore	Reach, Penetration, Low Steam, Low pressure/High flow, Durable, CAFS, Lower cost, Easy to operate	No flow control, Reduced flexibility, No spray pattern, Minimal cooling
Fixed Orifice	Straight jet and spray capability, Operate over a range of pressures (3.5 to 7 bar), Water and foam capability, Easy to operate, Lowest cost combination nozzle	Minimal flow control, Higher cost than solid bore, Greater steam potential than solid bore
Adjustable Orifice	Straight jet and spray capability, Flow control by nozzle operator, Operates over a wide flow and pressure range, Water and foam capability	Higher cost than solid bore and fixed orifice, Greater steam potential than solid bore, More training required
Constant Pressure	Straight jet and spray capability, Adjusts to maintain pressure and stream appearance, Water and foam capability	Higher cost than solid bore, fixed orifice, and adjustable orifice, More pump training required, Not good at low pressure, Restricts flow, Greater steam potential than solid bore
Multi-purpose	Reach, Penetration, Low Steam, Low pressure/High flow in solid bore setting, Straight jet and spray capability, Water and foam capability, CAFS, Easy to change from solid bore to spray while flowing	Higher cost than solid bore and fixed orifice, More training required,

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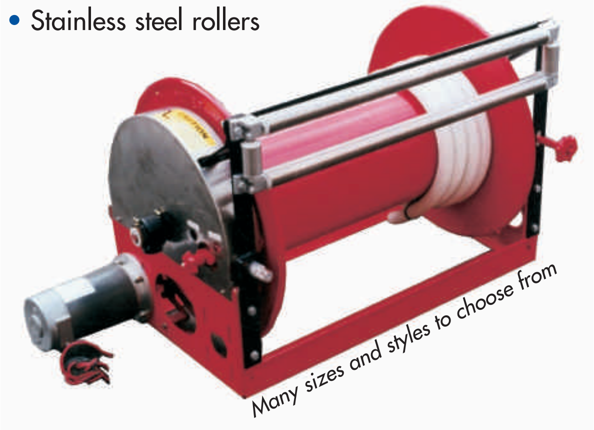

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Cover: Heavy Duty 420 Denier nylon (P.U. coated) UV/Chemical resistant and fire retardant

DAT™ 2020S STANDARD EQUIPMENT
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The DAT™ 2020S also comes complete with a qty. of 6 spray nozzle heads and a single 10' length of coiled, ½" hose with an attached multiple function spray gun with spray patterns and flows meant to gently, yet thoroughly, drench and decon victims. Flows per shower head and per spray gun = approx. 1 gpm optimum and dependent on water volumes available. Simply inflate the unit and plug into a water supply and commence decontamination in less than 1 minute. Multiple optional accessories available.

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Hose Size (mm)	Flow Range (LPM)	Fire Fighters (min.)
19	Up to 230	1
25	Up to 230	1
38	230-475	1
45	230-750	2
52	360-950	2
65	950-1900	3

45 mm hose but will only have one fire fighter on the line you will be limited to a nozzle flowing up to 475 lpm. If you have two fire fighters available, then you can go with a nozzle capable of up to 750 lpm. If you would like to flow up to 750 lpm and have two fire fighters available you will need at least a 45 mm size hose. On the other hand putting a 750 lpm nozzle on a 38 mm hose will be putting a nozzle larger than your hose will supply.

BRAND

Once you have determined the TYPE and SIZE you need, the BRAND of nozzle is your next decision. When choosing a brand, there are a number of important factors to consider. These factors include:

1. **Quality** – You can look at the fit and basic functions of the nozzle. How the parts fit together and how smooth the nozzle operates its basic functions, particularly while flowing. You should also take into consideration a brands reputation and performance in the field where they are being used on a daily basis.

2. **Durability of Materials** – You want to make sure that the materials used in the construction of the nozzle are of high quality and have been proven to hold up under the rigorous conditions of the fire service. This can be determined by feedback from current users and by full compliance to NFPA 1964.

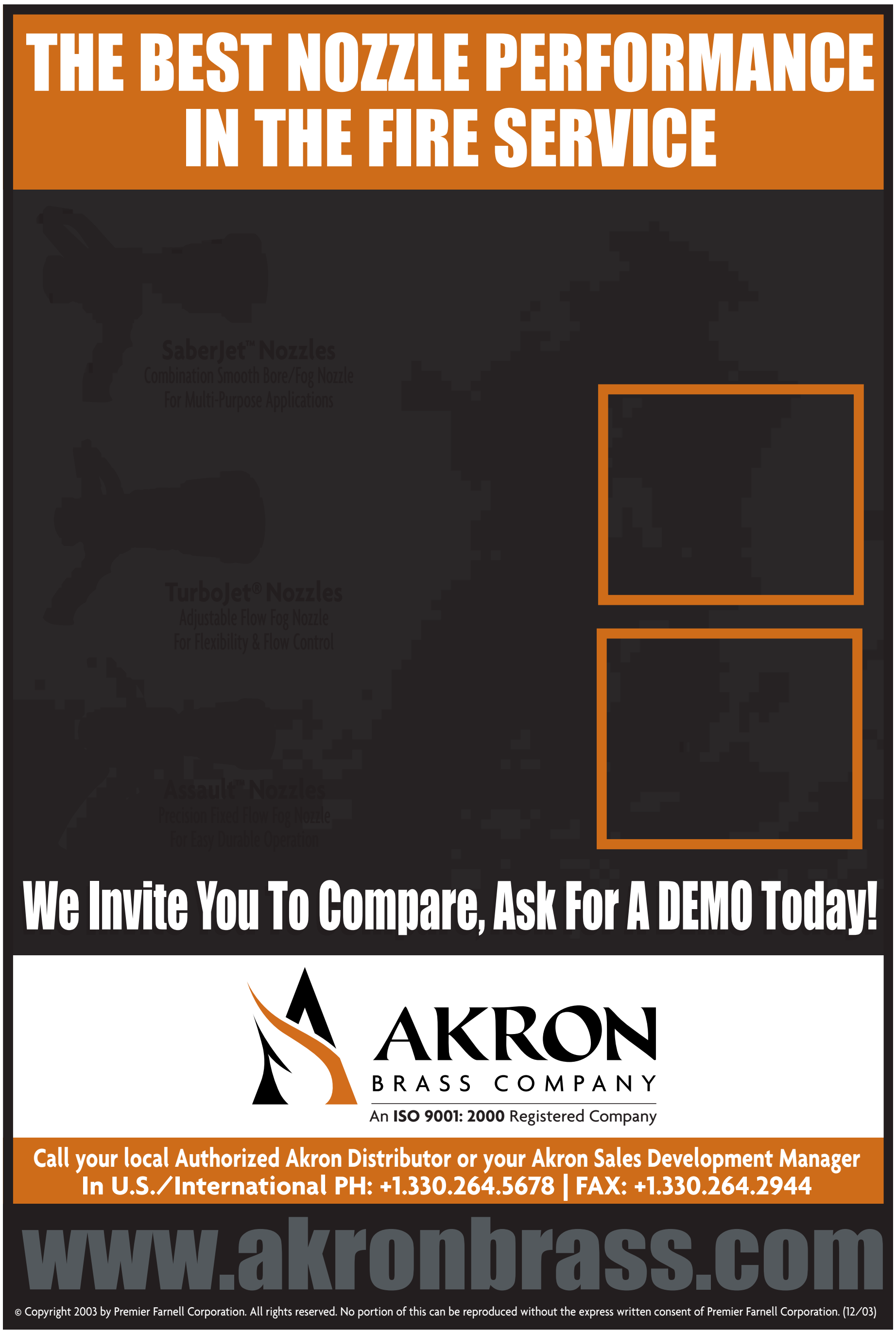
3. **NFPA 1964 Compliance** – A nozzle design that has been certified to be fully compliant to NFPA 1964 gives you assurance that the design has been tested to all the stringent tests required by NFPA. To assure there is full compliance a listing of the test results is required to be available upon request. It is also a good idea to make sure the manufacturer providing the certification is either ISO 9001 certified or uses a certified third party testing company.

4. **Service** – It is inevitable that any nozzle will need service over its life. Therefore it is important that the manufacturer be able to provide service parts and technical support for the nozzle. The manufacturers reputation for service and support is the best indicator of the level of service to expect.

5. **Price** – Although there is the selling price, the real price includes the value of the Quality, Durability, NFPA Compliance, and Service. All these factors play a role in determining the real total value of the nozzle you purchase.

Once you have evaluated all your criteria and narrowed your selection you should be much more comfortable that your nozzle choice will be well suited for your brigades needs. You may find that more than one type of nozzle in a given size, meets your needs. If this is the case, then the choice comes down to choosing the brand that you feel will provide you with the most value. Remember that although price is important, looking at the total value will serve you better in the long run.

Mark Saner is the Director of Product Development for the Akron Brass Company. He has served in various capacities at Akron Brass for 26 years and has been directly involved with nozzle development for most of those years. He has also been a principle member of the NFPA 1964 Spray Nozzle standard committee since 1992.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Flames, Trains and Tunnels

By Ken Anderson

Picture courtesy of CSIRO Fire Science and Technology

UNDERGROUND TRANSPORT TUNNELS are becoming increasingly popular in the modern world, as the global population edges closer to 7 billion, and the number of travellers and commuters jamming roads every day, reaches epidemic proportions. Governments, in developed and developing countries, have come to realise the potential of underground tunnels as a solution for traffic congestion, environmental damage and escalating transport-related costs.

UNDERGROUND TRAVELLING – WORLD PROPOSALS

The construction of underground transport tunnels is a growth industry with numerous proposals and projects underway on an international scale. In Australia, the Parramatta to Chatswood line will extend for 28 kilometres (most of it underground) and the Cross City Tunnel for 1.7 km.

Switzerland has four tunnel projects planned, Austria 4 and Beijing plans to construct around 150 km of underground rail in the years to come. Athens, home of the next Olympics, has commenced work on 24 kilometres of underground rail and the first part of the Bangkok underground system (8.7 km) has been completed.

Other extensive projects are planned in India, Ho Chi Minh City (Vietnam) and Guangzhou, to name a few.

Interest in underground transport systems persists despite several large scale incidents involving fires and passenger deaths, such as the Austrian ski resort train tunnel fire of 2000. In that incident, a steep underground 3.2 kilometre tunnel (maximum gradient 50%) turned into a huge chimney-like incinerator when a fire broke out on a stalled train.

The incident was reportedly the result of a combination of factors involving design faults (both with respect to the train and the tunnel), inappropriate use of a heater and a lack of safety, evacuation and exit measures (again with respect to both the tunnel and the train).

The accident served to highlight the need for updated models and methodologies that can be used to predict fire spread and growth on trains, and in tunnels, with the ultimate goal of enhancing consumer safety.

GET OFF A BURNING TRAIN WITH CSIRO

Train carriages and fixtures are constructed using numerous individual materials. Each material (be it wood, plastic or something else) will ignite and burn in a different way. Taken together, the burning behaviour of each individual material will make up the “fire load” of a train. In the Austrian train fire, for example, piles of discarded ski clothing provided fuel for the fire by adding to the train’s fire load.

One of the problems with the current (traditional) fire estimation methods is that a large element of guesswork is used in predicting fire spread. The other is that the burning properties of different materials are not taken into account, nor are assessments made of what contribution the tunnel itself makes (for example, ventilation or tunnel surface materials).

CSIRO Australia is currently working on the missing link – advanced modelling – that can accurately estimate the fire load of a train using complex mathematical equations. The project is headed by Vince Dowling of the Fire Science and Technology Laboratory (FSTL).

Dowling says, “Modelling can consider the nature and orientation of materials and the influence of environmental factors such as availability of air for the fire to burn. There are simple relationships in existence that give guidance on the likely maximum fire sizes in enclosures such as saloons in rail cars. If we assume a fire spread rate for individual materials based on their observed performance in the Cone

Flames, Trains and Tunnels

Calorimeter*, instead of assuming all surfaces are burning at the one time, we can derive a formula for determining the contribution of that material to the fire".

Such modelling would allow for appropriate safety and emergency measures to be taken in the event of a fire, without having to rely on guesstimates and inaccurate predictions. For example, if it is known that fire will not spread from one carriage to another for say 45 minutes, then calculations can be made about whether the train should proceed to the closest station for evacuation of passengers, or to the nearest emergency exit stair case.

BURNING A TRAIN AND TESTING THE METHOD

The next step in testing the new methodology is real life testing – eventually burning a real train in a real tunnel.

The first rail carriage experiments in this programme have been completed and were conducted in collaboration with Queensland Rail (QR) and Queensland Fire and Rescue Service (QFRS).

The objectives of the experiments were to:

- Investigate the fire size resulting from application of different ignition sources in a typical passenger rail vehicle
- Develop an understanding of how a fire develops and spreads in a typical passenger rail vehicle.

The testing was undertaken by a team of scientists under Mr Vince Dowling. Data collected, is now being analysed by Dr Vivek Apte of FSTL.

Dr Apte says: "The burning train experiment will enable us to assess the fire load of individual materials such as seats, lining and carpets etc, make calculations about what contribution those materials will make to the fire as a whole, and to assess what contribution the tunnel itself – its design, construction and ventilation etc, will make to the fire". This will enable us to estimate a "design fire" – indicating the likely fire size, in the event of a fire incident in the tunnel. Such realistic estimates of "design fire" could then be used by fire engineers to design the tunnel and the ventilation system.

Importantly, the new methodology will not only benefit the operators of rail transport but also the operators of other types of transport tunnels.

Dr Apte says, "Preventing fire hazards and estimating fire growth and behaviour is not only important for trains and tunnels, but for any type of transport tunnel. If a fire broke out in the Sydney Harbour Tunnel for example fire growth estimation models would be imperative for getting consumers out safely".

EXISTING UNDERGROUND TUNNELS BENEFIT TOO

New fire prediction methods being developed by CSIRO will not only benefit the operators and users of proposed tunnels but also those already in existence. In Sydney alone, there is the Sydney Harbour Tunnel (2.3 km), the Eastern Distributor Tunnel (1.7 km) and the M5 East Tunnel (3.4 km).

Around the world, there are hundreds of underground transport tunnels – rail, road, trams – such as the London underground, the New York subway, the Thames Tunnel, the French metro, the France/Italy road tunnel, the England-Wales subsea rail tunnel, the Singapore MRT, the Denver to Salt Lake City tunnel (the longest in the world) and the Swissmetro. The list is endless.

The models being developed by CSIRO will enable train manufacturers and rail operators to make better decisions about the materials they choose for the construction of tunnels and trains. Fire-retardant materials such as concrete, stone, ceramics, metal and glass will help to minimise the overall potential 'fire load' of trains and tunnels and enhance consumer safety.

For further information,
please contact:
CSIRO Fire Science & Technology
please visit
http://www.dbce.csiro.au/brochures/firetest

Or for more information on the
CSIRO FSTL facility please visit:
http://www.dbce.csiro.au/innovation/2001-02/new_firelab.htm

Picture courtesy of CSIRO Fire Science and Technology

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*The CSIRO FSTL cone calorimeter (CC) determines the rate of heat, smoke and gas release for modelling and other purposes. The CC is able to operate under reduced oxygen conditions (0 to 21% oxygen) and will offer real-time Fourier transform infra red spectrophotometry (FTIR) toxic gas analysis in the near future.

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Analog Addressable *versus* Conventional Fire Alarm Systems:

Pinpointing the differences so you can better address your needs

By Jack Grones and Brian Foltz, Applications Engineers for Silent Knight, Inc.

Analog/addressable fire alarm control panels (FACPs), like the Farenhyt IFP-100 from Silent Knight, feature addressable devices or points that can be individually identified. Analog/addressable FACPs often include other capabilities. The IFP-100 features 127 addressable points, single button reset and silence functions, a built-in digital communicator, a programmable zone or point reporting capability, and an enhanced user interface.

THE TERM "CONVENTIONAL" connotes that something is commonly used or done. But this is a term that is extremely time-sensitive. Conventions change – the license to call something "conventional" runs out every few years. What was considered a conventional oven or telephone or radio or computer ten years ago is very different from today's "conventional" versions of these products. Even previously unconventional products like a cell phone have their own advanced offshoots with features like image transmission and Internet access.

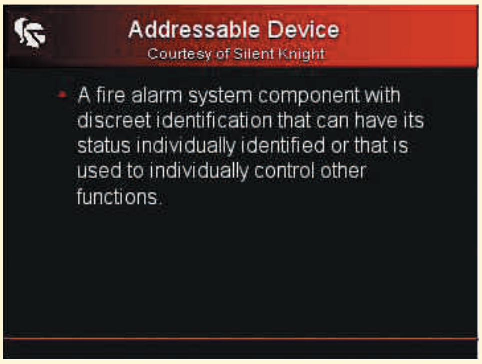
The point is, technology is advancing at heretofore unimagined speeds and it is up to individual buyers to determine whether "conventional" items meet their needs or whether they need to take advantage of newer technologies that veer from the norm.

In the fire alarm industry, there are two principal options for fire alarm systems: conventional systems, and analog/addressable systems. As you might imagine, there was a time not too long ago when conventional systems were the systems of choice for most buildings. But with changes in technology, costs, perceptions and agency codes, addressable systems have gained momentum over the last ten to fifteen years.

This article will help you understand the differences between the two types of fire alarms systems, with the ultimate goal being to provide you with the necessary information to make the best choice for you building's fire safety needs.

DEFINING YOUR OPTIONS

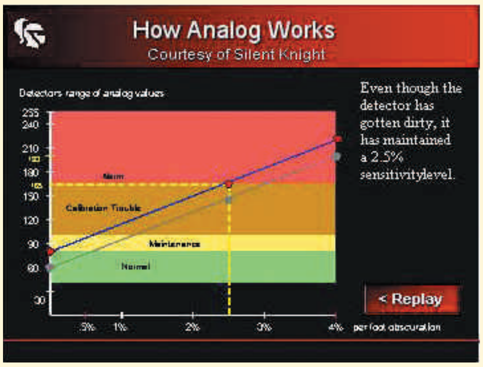
An "addressable" fire alarm system is one which provides the user with the status of the initiating devices that comprise the system network, be they smoke detectors, water flow switches, manual fire alarm boxes or other emergency equipment. This status is easily viewed on the fire alarm system control unit, and features not only information about the emergency device but also detailed information about the device's "address." Digital addresses for each device can be assigned by the system hardware or software. The location of an operated addressable device is visibly indicated



Addressable Device

Courtesy of Silent Knight

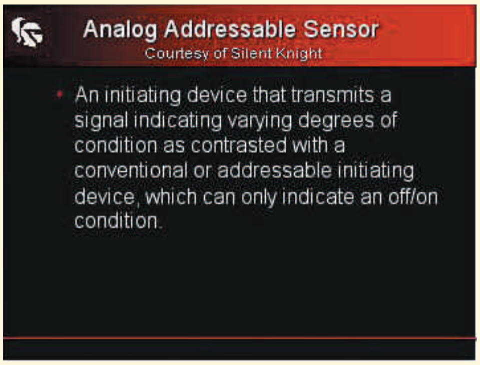
- A fire alarm system component with discreet identification that can have its status individually identified or that is used to individually control other functions.



How Analog Works

Courtesy of Silent Knight

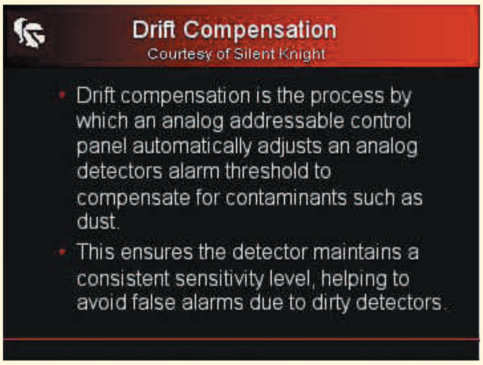
Even though the detector has gotten dirty, it has maintained a 2.5% sensitivitylevel.



Analog Addressable Sensor

Courtesy of Silent Knight

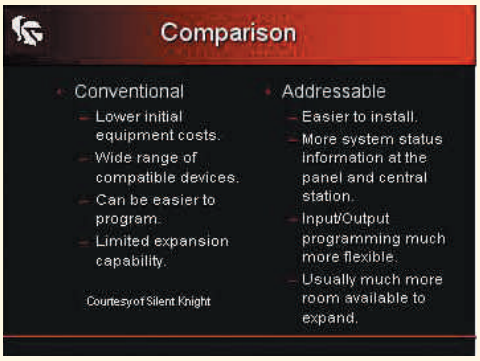
- An initiating device that transmits a signal indicating varying degrees of condition as contrasted with a conventional or addressable initiating device, which can only indicate an off/on condition.



Drift Compensation

Courtesy of Silent Knight

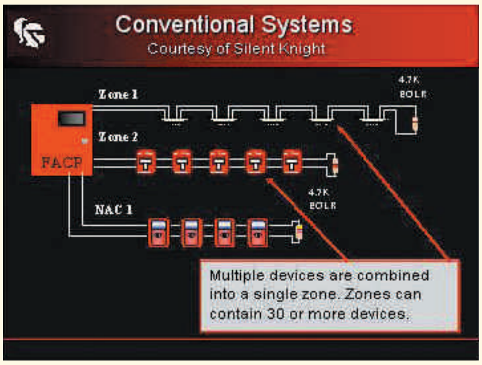
- Drift compensation is the process by which an analog addressable control panel automatically adjusts an analog detectors alarm threshold to compensate for contaminants such as dust.
- This ensures the detector maintains a consistent sensitivity level, helping to avoid false alarms due to dirty detectors.



Comparison

- Conventional
  - Lower initial equipment costs.
  - Wide range of compatible devices.
  - Can be easier to program.
  - Limited expansion capability.
- Addressable
  - Easier to install.
  - More system status information at the panel and central station.
  - Input/Output programming much more flexible.
  - Usually much more room available to expand.

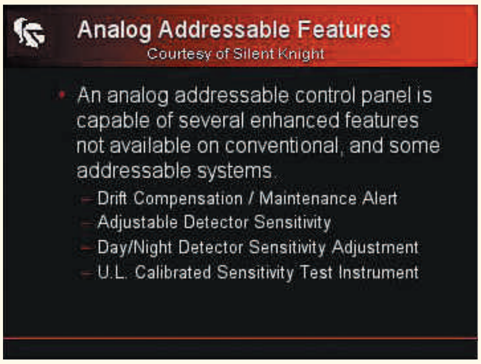
Courtesy of Silent Knight



Conventional Systems

Courtesy of Silent Knight

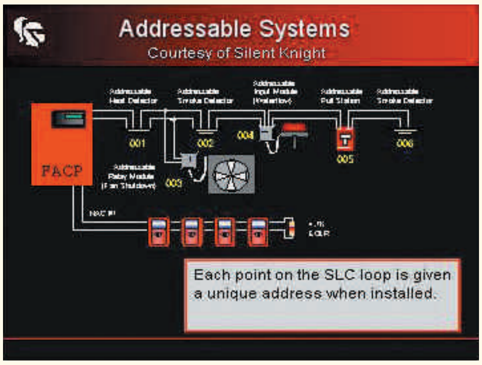
Multiple devices are combined into a single zone. Zones can contain 30 or more devices.



Analog Addressable Features

Courtesy of Silent Knight

- An analog addressable control panel is capable of several enhanced features not available on conventional, and some addressable systems.
  - Drift Compensation / Maintenance Alert
  - Adjustable Detector Sensitivity
  - Day/Night Detector Sensitivity Adjustment
  - U.L. Calibrated Sensitivity Test Instrument



Addressable Systems

Courtesy of Silent Knight

Addressable Heat Detector
Addressable Smoke Detector
Addressable Input Module
Addressable Pull Station
Addressable Smoke Detector
FACP
001
002
004
005
006
Addressable Relay Module (Fan Shutdown)
003
NAC #1
EOLR

Each point on the SLC loop is given a unique address when installed.

according to building, floor fire zone, or other approved subdivision, and also communicated via annunciation, printout or another chosen means of communication.

An "analog addressable" system takes addressable systems one step further. It has all the characteristics and features of an addressable system, but also expands on the information provided to the control panel. Detectors in an analog addressable systems become "sensors" that relay information to the control panel regarding how much smoke or heat the detector is sensing. The control panel is then able to make action-taking decisions based on this higher level of information, including when or when not to go into alarm mode.

In simplest terms, the primary benefit of an analog addressable system, and the trait that separates it from conventional systems, is that it allows an exchange of data between the panel and the activated sensor or sensors. Conventional systems feature groups of initiating devices combined into individual zones grouped on a single loop and linked to a control panel. These systems feature lower initial costs, but deliver far less information about activated devices and are unable to identify individual trouble-spots. With conventional systems, it is up to the control panel operator to determine exactly where and why an alarm has sounded (and this is a process which could even involve physically exploring the building).

BREAKING WITH CONVENTION

Though conventional systems still find refuge in some smaller jobs, it is becoming far and large the job of the newer analog addressable systems to handle fire control safety for both small and large jobs alike. This is because advancements in technology make even small applications appropriate for analog addressable systems. Unlike older addressable systems, newer analog addressable products are just as easy to program as conventional systems, and are also easy to maintain. With the ease-of-installation and maintenance of the new analog addressable systems, they are fast becoming the choice of the future and will in themselves become the "convention."

Also, consider the safety issues. The NFPA has. The National Fire Protection Agency (NFPA), a preeminent code writing authority in the fire alarm industry, has recognized the safety advantages of analog addressable systems. In fact, according to Richard Roux, Senior Electrical Engineer for the NFPA, addressable multiplex devices are a significant improvement over non-addressable technologies.

One clear advantage is an analog addressable device's ability to pinpoint a fire's "address," greatly accelerating the potential speed of response. This information is not only annunciated locally but is usually also communicated digitally to the central station or fire department. There is no need to track down the activated device on foot to determine the proper course of action.

Also because detectors in an analog addressable system act as "sensors" that exchange information, the right action is set in motion immediately right at the control panel. The level of the sensitivity of these devices is completely at the system manager's control. One can lower the sensitivity level at night when it might be unmanned and raise it during the day.

Guidelines for the Facility Manager When Buying a Fire Alarm System

1. Purchase a system that is appropriate for your needs. Don't overkill the problem.
2. Lay out the system in advance. Determine how many addressable devices you need, and what type: smoke detectors, heat detectors, relay modules, pull stations, and various monitoring switches.
3. Give yourself room to grow. If you need 25 devices, purchase a system that supports at least 15-20% more than that in anticipation of future growth.
4. Be sure that you feel comfortable with the system and its operation. The controls should be simple to use and laid out in a way that makes practical sense.
5. Buy a system that you'll be happy with for an extended period of time – at least 5 to 10 years. Be prepared to add on to the system before you have to replace it.

CATCHING THE DRIFT

It is also important to note that analog addressable devices are far less prone to false alarms. Unlike conventional alarms which can get false readings from the accumulation of dust and other contaminants, analog detectors are able to self-compensate for these smoke-reading inhibitors. With this "drift compensation" analog detectors are able to distinguish between a long term drift in smoke detection due to contaminants and a short term change in smoke detection resulting from a real fire. Analog detectors can be adjusted when they are recognized as having become defective or dirty, so that system sensitivity can remain consistent and detectors can function at the proper levels day in and day out.

COMING DOWN TO THE WIRES

Despite their advanced capabilities, analog addressable systems are surprisingly simple to install and maintain. In fact, a complete analog addressable system can run a single pair of wires depending on system size. This is known as the SLC loop or Signaling Line Circuit. This type of system also allows the use of T-Tapping, which can not be done on a conventional system. Compare this with a conventional system which will have many pairs of wires all coming back to the main panel. Naturally, the installation of analog addressable wiring is easier, and the maintenance and trouble-shooting costs are dramatically lower.

Because of the simplicity of the wiring and the analog addressable system's ability to pinpoint a real problem (and separate it form a dust-related problem), maintenance calls require less manpower, take less time and are more likely to fix the problem the first time. This all leads to lower service costs, better performance and, as a result, improved life safety. The simplicity of the analog addressable system also leads to greater flexibility, both in terms of programming options and opportunities for expansion.

ADDRESSING YOUR UNIQUE NEEDS

Even within the realm of analog addressable systems, there are a great variety of features and options from which to choose. You need to pick the type of detectors that are right for your needs and budget, as well as the right control panel. And then you have to wade through all the available system features – everything from different interfaces to built-in digital communicators to automatic sensitivity checks and maintenance alerts.

What should be clear though, is that if you have a sizable facility to protect, the conventional fire alarm system is not necessarily the best option. In pursuit of maximum safety and value, more and more facility managers are breaking with convention and pinpointing analog addressable systems as their systems of choice.

Jack Grones has been with Silent Knight for 25 years as a Repair Technician, Technical Support Supervisor, and Applications Engineer. He is NICET certified.

Brian Foltz has been with Silent Knight for 18 years as a Technical Writer, Sr. Engineering Technician, and Applications Engineer. He is also in charge of Regulatory Compliance and is NICET certified.

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HI-FOG – WATER MIST'S EFFECT UNMATCHABLE

The HI-FOG high-pressure water mist system is the right choice for safe fire protection. It replaces both conventional sprinklers and gaseous systems, providing safety for the people, property and the environment.

HI-FOG, developed and supplied by Marioff, is an innovative fire protection technology utilizing high pressure to create fine water mist. HI-FOG systems are providing fire protection for a variety of applications – and providing higher levels of safety to people and equipment too. HI-FOG sprinkler systems are now protecting hotels, hospitals and large cruise ships around the world where superior fire suppression performance, easy installation and minimal water damage are key benefits. But different HI-FOG systems are also being specified for applications for which water would not normally be used – such as computer rooms and machinery spaces. Major deliveries to offshore platforms and petrochemical industry have recently been shipped.

HI-FOG fire testing. Over 5000 full scale fire tests have helped Marioff receive more approvals than any other water mist system manufacturer.

How does HI-FOG work ?

Conventional sprinklers and water spray systems fight fires by the inefficient process of wetting or cooling combustible surfaces. Low pressure mist systems are more efficient. But HI-FOG, a high pressure mist technology, uses water in the most efficient way, extinguishing by using three primary mechanisms: cooling, local oxygen depletion and radiant heat absorption. HI-FOG systems produce a large numbers of very small drops with a high surface area that leads to rapid evaporation of water.

HI-FOG systems are at least equally efficient at fire suppression with minimal water discharge. Water damages to the protected facility or equipment can be avoided. Clean-up time and costs are negligible. Tubes are small so installation is easy and fast, particularly on retrofits.

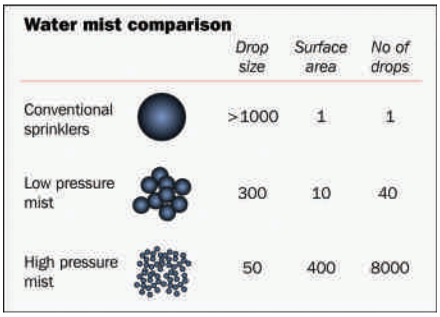
Tested and Approved

Over 5000 full scale fire tests have proved the effectiveness of HI-FOG systems. HI-FOG systems are engineered to meet IMO and NFPA 750 specifications and they have received the widest collection of approvals for water mist applications in the industry for example from Factory Mutual Research, Det Norske Veritas, Lloyds Register, Bureau Veritas, the German VdS and Germanischer Lloyd.

Approved HI-FOG systems are protecting turbines and machinery spaces for the largest energy companies in the world. Over 500 HI-FOG systems have been installed on cruise ships, ferries, luxury yachts, tanker ships, naval vessels, high speed crafts, cargo and sailing vessels around the world. London and Madrid underground metro systems use HI-FOG to protect their special fire risks. Systems are protecting F16 fighter aircraft hangars in Norway. Insurance companies, banks and leading telecom and data companies trust HI-FOG systems to protect valuable computer equipment from fire and smoke damage. And now HI-FOG sprinkler systems are also protecting hotels, offices, as well as historic and heritage buildings.

Development of water mist system in Asia Pacific

Due to the ease of installation and our pre-engineered system, HI-FOG had been successfully installed and commissioned throughout Asia Pacific. In Singapore Chinatown, it's has been installed to protect the kitchen hood and units of a newly refurnished hotel. We had also protected computer rooms for a local MNC and even demonstration unit for one of the Polytechnic. In future HI-FOG system will protect one cable tunnel in Asia Pacific area. In various parts in Malaysia, HI-FOG system had been found to be protecting computer rooms, transformers, switchgear room, gen sets room and telecommunication room for various MNC.



Water mist comparison

	Drop size	Surface area	No of drops
Conventional sprinklers	>1000	1	1
Low pressure mist	300	10	40
High pressure mist	50	400	8000

HI-FOG droplet size

A SPU (Sprinkler Pump Unit) system is used in sprinkler applications and total volume protection of large machinery spaces.

In Taiwan, an indoor transformer for a semiconductor plant was also protected by our HI-FOG system. We had also protected a engine test cell as well as a machinery space.

Moving to Down Under, HI-FOG system has also been protecting computer rooms, flammable liquid store and even HV switch rooms and HV equipment.

Therefore, based on the list of projects stated above, HI-FOG water mist system has not only been able to be successfully installed around Asia Pacific but also it has proven to be reliably replacing the sprinklers and gaseous system without a hitch.

Marioff currently markets and sells HI-FOG systems in twelve countries directly to end customers through own subsidiary companies to ensure the quality of application engineering, installation and commissioning. Distributors and agents in other areas are provided with strong support and coordination from corporate headquarters.

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Vigorous decon equipment maintenance programmes

By Mark Whitcher,
Managing Director,
Professional Protection
Systems Ltd.

Picture courtesy of PPS

An essential part of homeland defence

Currently a great deal of money is being invested by governments and other institutions throughout the world in terrorist response capability. A not insignificant slice of this money is going on the purchase of decontamination technology. For this investment to be effective it is axiomatic that emergency services personnel have to know how to use the equipment and how to maintain it.

Maintenance in particular is an issue because decon technology is essentially about a defensive technology that in most cases will never have to be used, save of course for the smaller purpose built units deployed at events like hazmat incidents. Because of this there will always be an understandable tendency for hard-pressed and over-stretched emergency service personnel to marginalize the need for regular checks on the incident-readiness of equipment in this category, especially when they have so much else that seems to be more immediate, if not more important, on their plates.

These checks can be likened to lifeboat drills and maintenance. The fact that the ship will probably never sink doesn't mean that there is no need for regular checks and maintenance to ensure that the boats can be launched if necessary. It is a programme essentially applicable to most decon units to be found in service anywhere in the world. It addresses maintenance in depth, putting the smallest details under the microscope whilst also offering depth in terms of time.

This maintenance programme is based on a five-year life span for inflatable units and 10 years for mechanical units. In fact applying this kind of programme will prolong the life of either type of unit considerably beyond those periods, but technologies are changing rapidly and units now in service will probably be obsolescent in a decade.

> *Any viable maintenance programme depends on a close co-operation between manufacturer and user. Practically this means the end user has to be offered some insight into the manufacture of the product, as well as hands-on experience of the equipment in its pre-delivery state.*

Vigorous decon equipment maintenance programmes

Picture courtesy of PPS

Any viable maintenance programme depends on a close co-operation between manufacturer and user. Practically this means the end user has to be offered some insight into the manufacture of the product, as well as hands-on experience of the equipment in its pre-delivery state. The aim is to develop familiarity with the product in a hands-on way. This is of course not a substitute for operational training exercises, rather it is the up-stream part of these, where the user can learn to deploy the units with the maximum of technical accuracy. It is only when operatives are familiar with the possibilities of decon equipment that they can carry out the maintenance checks. In practice these are slightly different for inflatable units and the new big mechanical homeland defence mass decon units. For either to function however close attention has to be paid to the accessories which both types of decon shower enjoy in

> *Water and air heaters, generators, pumps and even non-mechanical items like raised flooring, waste water tanks, couplings and hoses, if they are not constantly monitored, may have an effect on the inherent operational liability of the equipment.*

AUTOFLUG

Dedication to the rescue and safety of people, this has been the objective of AUTOFLUG already since the first days of aviation. From the foundation of the company in 1919 right up to the present day, AUTOFLUG has remained a medium-sized family enterprise.

AUTOFLUG supplies humanitarian rescue services with safety systems such as inflatable life tents, inflatable decontamination tents and showers, inflatable rescue stretchers, inflatable dinghies and manifold accessories for all AUTOFLUG inflatable equipment.

AUTOFLUG rescue and safety systems incorporate the latest experiences, are based on newest materials and technologies and are meeting the highest requirements.

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common. Water and air heaters, generators, pumps and even non-mechanical items like raised flooring, waste water tanks, couplings and hoses, if they are not constantly monitored, may have an effect on the inherent operational liability of the equipment.

As far as mechanical equipment is concerned procedures must be provided for inspecting all units for signs of wear or damage. Also it provides for regular checks on items like oil levels, signs of fuel contamination, the state of electrical cables and connections as well as regular inspection of water connections and fuel lines for wear or damage. An important part of the procedure is to start up all units and confirm that they are operational within their specified limits. Lastly, and most importantly, a worthwhile maintenance programme must instruct, after cleaning and testing and the fastening of appropriate test labels, how equipment should be packed away in such a manner that it could spring into instant life.

Inflatable units have their own special procedures. All equipment appertaining to them needs first to be checked against the inventory list then the unit has to be inflated and monitored out for obvious leaks Particular attention must be paid to welded seams and the containment, doors and zips have also to be examined for damage or wear.

Features like loops, light port holes, groundsheets, water sumps and curtains must also be inspected for damage or wear. Water systems have to be subjected to similar procedures. Features like detergent injection systems have to be inspected for blockages or signs of damage.

The structures of the second-generation Mass Decon units, because they are mechanical and work on an articulated frame technology, are subject to different maintenance issues. They have an immediate advantage over the first generation products as absolutely no air whatsoever is involved when they are deployed. The strength of the inflatable, still the numero uno for smaller scale situations, resides in the fact that it can usually be rapidly and relatively easily repaired and made ready for action again. Whilst a second-generation unit

Picture courtesy of PPS

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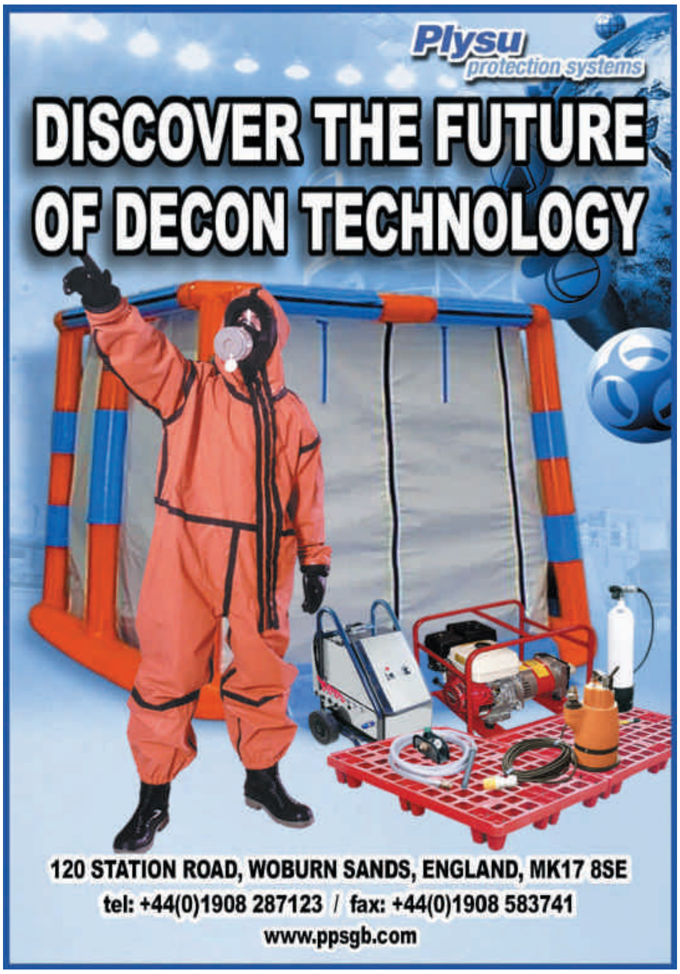
Picture courtesy of PPS

is unlikely to present any serious maintenance issues any problem with the mechanical structure is going to need a professional engineer to fix it. The solution to this is that as soon as the problem is located the defective unit is removed for repair and a substitute put in its place. These new units, capable of handling 200 ambulant and 20 plus non-ambulant casualties per hour are becoming flag ship units of the emergency services. Their metal frames are of enormous complexity and if they do require attention it has to be from a dedicated frame specialist. Fortunately because of the fine tolerances to which they are made and the aircraft grade aluminium from which they are manufactured this is an unlikely event. Also they are so designed that they can remain in action even if 30% of the frame is damaged. It is essential however that even when held in store these units should be erected from time to time and rigorously examined for any faults.



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It will be clear from this that the decontamination unit has evolved rapidly into an infinitely more complex piece of technology than the original units first introduced in 1996. For this reason the future is going to mean manufacturers working ever closer with end users. Also those manufacturers are going to have to be outfits with an international reach able to offer complex services as a matter of course. This means the day of the cottage-industry supplier has finally gone.

Besides the end user coming to the manufacturing unit this new dispensation will involve the manufacturer in carrying out annual site inspections This will be backed up by an access controlled website containing downloadable instructions for all products plus advice on fault tracing. A 24-hour telephone hot line for advice will also be part of the package plus a round the clock-call out service.

Currently we are working on ratcheting up this level of service by the introduction of an on-going Decon Users Forum. This will enable end users to feed back information on all aspects of equipment use and performance. This in turn gives the manufacturer the possibility to continually fine tune products and thus deliver ever-improving performance to our customers, the people at the sharp end. I hope this proves that the need for a well thought out maintenance programme for decon equipment is a very real and valid one that is going to be at the heart of the best decon manufacturers' relationships with their customers.

Tomorrow's technology today

VIBRAPHONE® ASB-8 & VIBRASCOPE® BVA-6:

TWO INNOVATIVE 'VICTIM LOCATION SYSTEMS' FOR SEARCH & RESCUE OPERATIONS!

As a manufacturer of positive pressure ventilators (PPV) and environmentally friendly fire simulators, Groupe Leader is a French company, specialising since 1985 in the supply of innovative fire fighting equipment. Groupe Leader is therefore pleased to present two outstanding items of equipment for assisting search and rescue operations: the Vibraphone® ASB-8 and the Vibrascope® BVA-6.

At the time of a building collapse (explosion, earthquake) or of a landslide, people can be buried under the ground or beneath piles of debris. These people may survive several days, in particular if they are in a zone, which contains sufficient air to be able to breathe. It is then essential to locate the victims promptly in order to release them as quickly as possible. To achieve this we have various senses (hearing, sight, touch, sense of smell), teams (dogs), equipment for listening, and visual (infra-red cameras, endoscopes).

The search for trapped victims is initially carried out by collating on-site information (estimate of the number and possible positioning of the victims), complete raking of the search area by the rescuers and dog teams, and finally by electronic equipment for picking up sounds or imagery.

VIBRAPHONE® ASB-8:

Basically, the Vibraphone® ASB-8, electronic listening equipment, is widely familiar to rescue teams throughout the world, having been used in earthquake zones in Turkey, Mexico and Armenia. It enables people buried under rubble, as a result of catastrophes, to be located quickly and accurately. The exceptional sensitivity of the Vibraphone® enables it to pick up the slightest sound made by disaster victims.

In order to carry out the various phases of research, it is very important to have absolute silence. However, at the time of a catastrophe of this type, it is very difficult to obtain complete silence. This is why the ASB-8 is fitted with an adjustable filter, which deadens the effect of dull noises like pneumatic drills, lorries passing etc.

A team of three people are necessary for the use of Vibraphone® ASB-8: a co-ordinator, who listens in using headphones. The co-ordinator controls the positioning of vibration and sound sensors and listens for any sounds recorded by the microphones as positioned by two other team members searching. According to sounds heard, the operator indicates to his team-members the location and placement of sensors, enabling them to approach victim/s as closely as possible.

VIBRASCOPE® BVA-6:

The Vibrascope® BVA-6 'snake-eye' camera enables existing channels in disaster rubble to be penetrated and for victims to be contacted via a microphone incorporated in the camera. It comprises a telescopic pole which is fitted with an infrared camera on the end. This camera can rotate 360 degrees, and transmit pictures back to a portable screen monitor. This equipment makes it possible to explore the debris and talk directly with a trapped victim via a microphone incorporated in the pole

For example, at the time of an earthquake where a person is buried, he manages to emit sounds but nobody manages to hear or locate him. The Vibrascope® is then the ideal material for this situation. Handled with care, it requires, like the Vibraphone®, a complete silence on site. The team works in unison: The coordinator, who has the audio and video return of the pole, indicates to his team mate if he may advance or move back so as to position the pole until locating as close as possible to the victim. Once located, it is then possible to communicate with victim, gaining important information on his state and condition, as well as reassuring him until the rescuers are able to release him from the debris.

The range of uses for the Vibrascope® vary from rescuing buried victims to surveillance and maintenance techniques for customs examinations, even archaeological investigations. . .

For more information, please contact:

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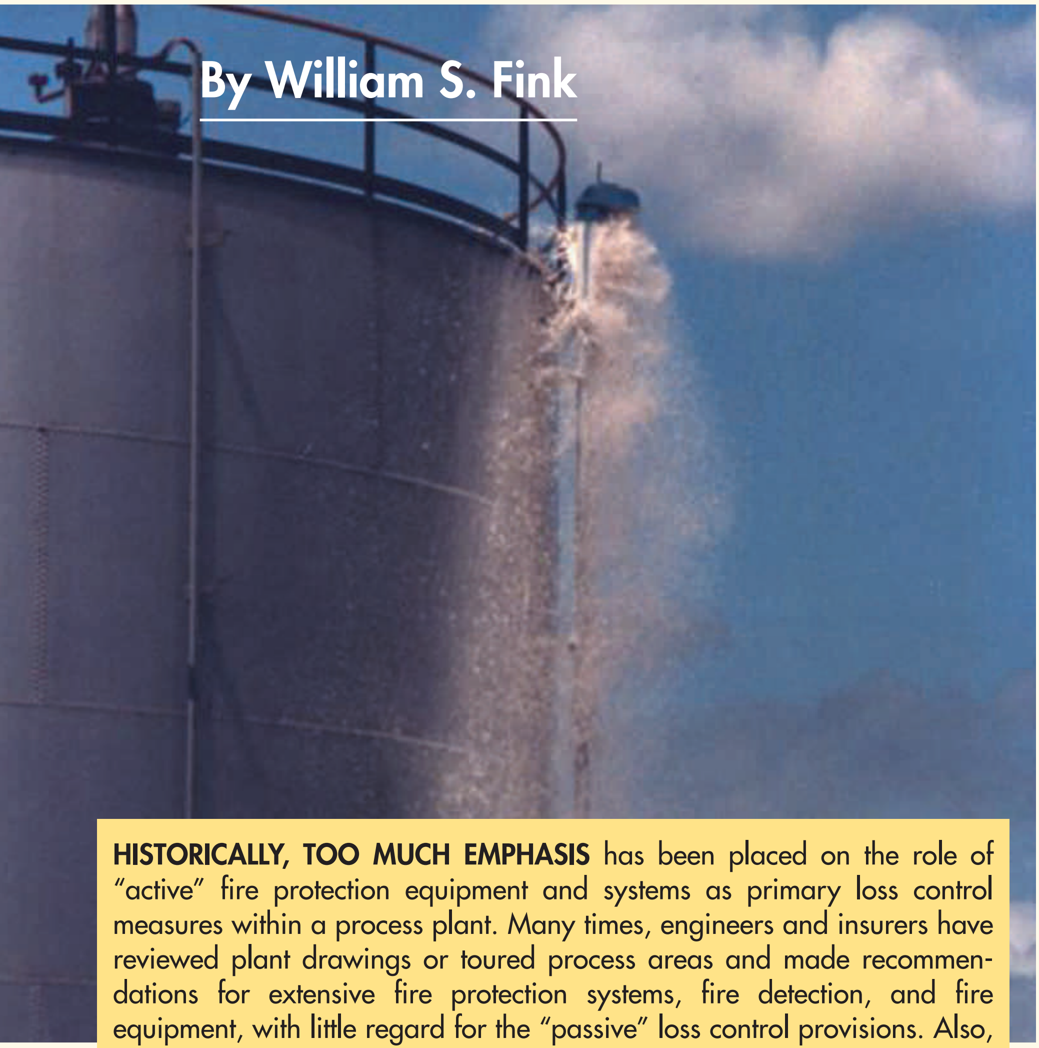
The Process Plant L



By William S. Fink

HISTORICALLY, TOO MUCH EMPHASIS has been placed on the role of "active" fire protection equipment and systems as primary loss control measures within a process plant. Many times, engineers and insurers have reviewed plant drawings or toured process areas and made recommendations for extensive fire protection systems, fire detection, and fire equipment, with little regard for the "passive" loss control provisions. Also, many designers do not fully understand the inter-relationship of the various sub-systems as they relate to loss control.

The objective of this article is to provide a better understanding of the overall loss control system in a process plant, from the design phase through the plant or unit's operational lifespan. It should be first understood that there is always a need for fire detection systems, fire protection equipment, and systems, but the provision of these systems should be balanced against other loss control measures that may have a greater impact on maintaining a safe process and preventing a release of material, fire, or explosion.

Process plant loss control is not just the provision of fire protection equipment and fire protection systems; it is a "system" in itself. This system begins very early in the design stage of a process plant and lives throughout the life of the process plant. It includes a variety of inter-related sub-systems that work together cohesively at the time of an incident to protect personnel, the public, adjacent assets, and limit any loss. These sub-systems can be categorized as "passive" and "active" based upon how they act or react during an incident.

For the purpose of this article, an "active" system is one that requires human intervention at the time of an incident to set some actions in motion. A "passive" system includes those design items or systems that require no human interaction and/or are designed to automatically take action under certain conditions. The figure below lists a number of the typical passive and active subsystems that may be employed in the loss control system. In some instances, the sub-systems, such as fire protection systems, may be passive if they are automatically activated, or active, if personnel must activate the system by opening a valve or pushing a button. A number of these sub-systems will be discussed to provide a better understanding of this inter-relationship.

DECISION TIME

Early in the budgeting stage for a revamp, modernization, de-bottlenecking, or grass-roots project decisions, should be made on the conceptual loss control measures that will be employed in both the design and operating phase of the plant. All too often these decisions are made without regard to the operating life of the plant.

For example, with the advent of improved process control and advanced control systems, many duties that were once performed by plant operating personnel are now performed by the control systems. As such, the manpower that was available to respond to a plant emergency has been reduced considerably. To compensate for these changes, the use of "passive" sub-systems should be increased.

Likewise, adjustments to the "active" sub-systems may be equally appropriate. In other words, as the manpower is reduced, additional design features should be considered to provide an equivalent level of protection. Traditionally, the operating staff that was needed in the process area to operate the process also played a key role in release or fire reporting. There may now be a need for automatic fire detection by systems such as combination infrared/ultraviolet fire detection equipment. The use of remotely operated closed circuit video cameras has also increased where the control room operator needs to see high-fire potential areas, such as pump rows or large compressors. There may be a need for remote isolation of high fire potential equipment such as pumps or compressors to rapidly isolate the source of the release and limit the loss.

LAYOUT AND SPACING

One of the best passive techniques in limiting a loss is through proper layout and spacing of equipment, both inter plant and intra plant. In the days of pneumatic controls, increasing separation distances between process plants and between individual equipment items was not feasible or cost effective due to the high cost of instrumentation and piping. This produced tight equipment arrays and minimized separation distances between process plants. Equipment such as heat exchangers, drums, separators, fin-fan

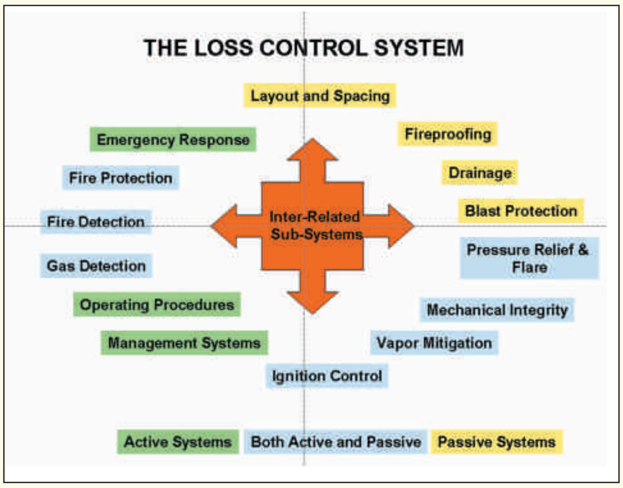
oss Control System

coolers have been commonly stacked on top of each other within structures to minimize costs and to fit a process in the given space available. Tight equipment arrays impact the degree of confinement when a vapor release occurs and may produce higher blast overpressures.

Technology has now advanced to the extent that we can assess the impact of equipment spacing on potential loss scenarios and make informed decisions on the amount of risk that a company can accept. Electronic distributed controls have largely replaced pneumatic control systems. As a result, the cost and operational impact of increasing spacing to provide better personnel access, egress, and reduce losses is not as severe.

With the current hard insurance market and high insurance premiums, the cost of risk should be carefully factored into plant design. For example, maximum loss calculations that largely determine the insurance premium to be paid should be given critical consideration when making decisions on the spacing and layout of a plant. In addition, the proximity of the public to the process plant should also play an important part in deciding how much "buffer" land is needed around the process area. Typically, lower risk facilities such as storage tanks, utilities, or green belts are placed between the process areas and the property lines. To reduce the maximum loss calculations, high value high fire potential processes can be separated by lower value, lower risk processes.

The costs of utilizing noncombustible fill in cooling towers as opposed to the traditional wood filled cooling towers has also decreased and can be offset by lower long-term maintenance costs. Limiting the amount of flammable liquid or gas in a given process vessel also has a significant impact of the loss control measures in a process. Operations personnel have traditionally wanted large liquid volumes to permit more time for operators to respond to a given situation. With the process control provided today, these inventories can in many instances be reduced since the process computer reacts more quickly and efficiently to an off-norm situation.



FIREPROOFING

Fireproofing should be provided for the protection of structural support and for the protection of critical instrumentation and/or power cables. Fireproofing is typically measured via laboratory testing that indicates the exposure time for a specific item, such as a structural steel member, to fail under fire conditions. In evaluating fireproofing ratings and test results, one must pay particular attention to the fire tests used in these ratings. In 1918, the standard time-temperature curve (ASTM E 119) was adopted for testing structural components and simulates interior structural building fires. This test method does not correlate well to hydrocarbon and other pool type fires.

In 1984, Underwriters Laboratories (UL) adopted the first high-rise time-temperature curve in conjunction with the oil industry (UL-1709). The high-rise time-temperature curve reaches a temperature of 2000°F (1093°C) in 5 minutes and is representative of a typical hydrocarbon pool fire. As such, fireproofing used in facilities that process hydrocarbon type fuels should provide fireproofing based upon the UL 1709 or equivalent testing techniques. The figure (next page) compares the standard time-temperature curve, and the high-rise time temperature curve.

American Petroleum Institute (API) Publication 2218, Fireproofing Practices in Petroleum and Petrochemical Processing Plants is an excellent reference document. It outlines a systematic methodology for assessing a potential hazard within a plant, developing appropriate fire scenarios, defining the fire-scenario envelope, conducting a needs analysis, selecting appropriate fireproofing systems, and installing the system according to specifications.

Picture courtesy of RJA

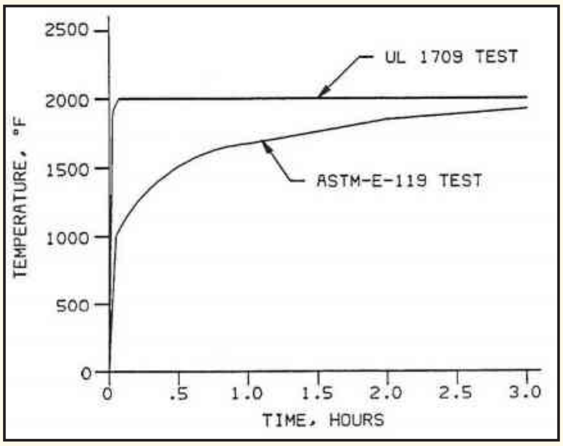
The amount of fireproofing that is provided should be balanced against the fire potential, the layout and spacing of buildings, equipment and vessels, and operating considerations. For example, where there is a need for operational control of valves during an incident, there may be a need to provide fireproofing of these systems or in the area adjacent to the valves for an extended period of time.

DRAINAGE

Proper drainage must be provided in the process areas to drain both rainwater run off and spilled process liquids from the area. When establishing the drainage patterns in a process area, the drainage patterns should be away from equipment to more open areas and out from under pipe racks and cable trays. As such, the high point of paving should be directly under the main pipe rack, which typically acts as the dividing line of drainage run off for the process area. Catch basins for the run off should not be located under equipment or pipe racks. For the protection of personnel, they should also not be located in areas where operating personnel may need access during an incident.

The goal is to provide enough slope away from the equipment to enable spilled liquids to drain rapidly into catch basins and not permit the build-up of large liquid pool fires under or adjacent to critical equipment arrays. The drainage should be properly sized to dispose of a realistic "worst-case" rainfall rate (e.g. – 2 inches in an hour), plus spilled process materials at an agreed upon rate, and firewater runoff.

Provisions to contain and dispose of contaminated fire water run off must also be adequate for the duration of an incident to prevent the drainage system from backing up into the process area.



Time temperature curve. *Courtesy of RJA*

BLAST PROTECTION

Buildings, which house personnel and are normally occupied, such as centralised control rooms, should preferably be located out of the estimated blast zones. These blast zones can be calculated based upon scenarios specific to the process and related materials and should be developed with input from design and operating personnel. Where buildings will be normally occupied and located in the blast zones, structures should be provided with blast resistant construction equal to the calculated blast overpressure for that area of the plant.

In some cases, protective films can be used over windows to limit flying glass that may result from the blast wave, when the building itself can withstand the blast overpressure generated. In more severe instances, windows may need to be deleted from the side of a building that faces the process area. In extreme cases, such as explosives plants, the control rooms may need to be constructed as a blast bunker with sloped walls so that the blast wave rides up and over the building. Where critical equipment such as deluge system valves are located or remote isolation valve controls, blast walls may be need to protect this equipment from the blast overpressure of an incident.

PRESSURE RELIEF & FLARES

In today's process plants, the pressure relief valves for flammable liquids and gases are more often than not routed to a closed system that provides for recovery of the material or proper disposal in a plant flare. The flare system includes piping that routes materials from the pressure relief valves, into a main header, through knock out drums where liquids are retained, and the remaining gas is burned in a flare. In many cases, there are vapor recovery systems that recover as much of this waste gas as is economically feasible.

The flare should be located at a safe distance from process areas, storage tanks, buildings, and other structures based upon radiant heat studies. These studies should include a detailed analysis of the time required for a pressure relief valve to relieve materials into the flare system, the anticipated temperature, quantity, pressure, and composition of materials in order to determine the maximum flare system loads. These maximum loads are used to design the hydraulics of the system and also to calculate the radiant heat from the flare.

The radiant heat calculations should result in a protected buffer zone around the flare to ensure that the radiant heat from the flare does not ignite combustible materials. These buffer zones should also include some consideration for the release of burning scale from the flare that may build up over long periods of use. There have been a number of fires where storage tank pressure/vacuum vents or seals just outside the radiant heat buffer zone have been ignited by burning scale carried down wind of the flare. Where this potential exists, additional protective measures may be required.

> *There have been a number of fires where storage tank pressure/vacuum vents or seals just outside the radiant heat buffer zone have been ignited by burning scale carried down wind of the flare. Where this potential exists, additional protective measures may be required.*

In some cases, the flare system may also include manually operated rapid depressuring valves that will quickly release pressure from a process vessel into the flare system. These rapid depressuring systems are typically used where there is a need to relieve pressure from a process vessel in a short duration to protect the process or the equipment. Where these systems are used, they should be considered "critical" systems and should be protected from fire exposure for a specified period of time (usually 15-20 minutes) to ensure that the system will properly function in the initial stages of a process unit emergency.

MECHANICAL INTEGRITY

The mechanical integrity aspects of the loss control system in a process plant are far-reaching and very complicated. The mechanical integrity program at a plant begins early in the design stage and remains active during the life of the plant. Some of the loss control contributions of the mechanical integrity program include the design specification for piping, process vessel, and storage tanks, pump and compressor seals, flange ratings, nondestructive inspection requirements, and many other items too numerous to describe here.

The potential for a release of material in any given process plant is influenced greatly by the decisions made early in the design stage. For example, on piping systems designed to handle corrosive flammable liquids, piping wall thickness specifications should include consideration of corrosion rates. The selection of piping materials is also determined by an assessment of the temperature, pressure, and composition of the materials being handled.

In some cases, the probability of a release from piping systems can be reduced greatly by using piping with a greater wall thickness. Another example would be the use of high integrity pump seal materials and/or double seals with monitoring of the space between the seals for leakage past the primary seal to prevent a release to the atmosphere.

The mechanical integrity program after the plant is operating also has a significant loss control contribution. The monitoring of vibration on pumps and other large rotating equipment provides data that can be used to predict a potential failure before it occurs. Firewater pumps should be included in the rotating equipment monitoring program since they are expected to function in a reliable fashion.

The ongoing periodic inspection of plant piping systems, pressure vessels, heaters, and boilers provides necessary data that can also predict a failure before it occurs. Pressure relief valves should be tested periodically to ensure that they are operable within acceptable limits and that process materials are not building up at the inlet to the pressure relief valve, reducing its capacity or ability to open fully when required. Failure of a relief valve can rapidly escalate into a major loss.

Fire protection equipment and systems must be included in the mechanical integrity program. Firewater spray and sprinkler systems require periodic maintenance and must be tested to verify that they remain operational. Foam systems on storage tanks also require testing. While it is understood that it is difficult to test these systems, some provisions can usually be made to test the equipment while it is in service. As a minimum, these systems should be tested when the plant is down for periodic maintenance. National Fire Protection Association, NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems should be consulted for more information.

FIRE PROTECTION SYSTEMS

Fire protection systems include fire detection and alarm systems, fire suppression systems, foam systems, and the provision of manual fire fighting equipment. These provisions are dictated in many instances by the local authorities and by national codes, such as the National Fire Protection Association codes. However, these provisions should also be balanced against the other loss control measures provided at the facility.

For example, if it is known that the drainage in an existing process area is inadequate and it may take several years to obtain capital funds to improve the drainage system, foam systems and equipment should be provided to suppress the vapors from spilled liquids or to control a pool fire in the area. If isolation of pumps or other equipment can only be accomplished at the equipment itself, then water spray or foam system protection should be provided in that area for personnel protection. Proper personal protective equipment should be provided in this example.

Likewise, if high fire potential equipment, such as hot oil pumps, are provided with high integrity seals, periodic rotating equipment vibration monitoring is conducted, the equipment is not located under a pipe rack or other equipment, and is provided with remotely activated shut down and isolation valves that are fireproofed, then the need for fire water sprays over the pumps may be questionable. In this case, the pump can be isolated during an emergency and shut off remotely with limited personnel exposure and with minimal damage to adjacent and overhead equipment. Active protection may not be a critical requirement in this scenario.

SUMMARY

The intent of this article is to identify some of the loss control contributions of various plant sub-systems to the overall loss control system. Some of the items included in the loss control system chart have not been discussed, but may be equally if not more important. As indicated, it is very difficult to totally isolate or separate the interaction of these sub-systems, but they should be considered on a "systems" basis. If they are not, improper protection may be provided, or not provided at all. Interrelationships between protective elements may be violated, and the loss control system may not be as effective as is should be. Finally, capital funds may be wasted on protection that is not required.

William S. Fink is a Sr. Consulting Engineer for Rolf Jensen & Associates, Inc. Denver, Colorado office. RJA is a global consulting firm specializing is fire protection and security engineering. Mr. Fink has over 24 years experience in processing and heavy industry loss control consulting and fire protection engineering. He is also a graduate of the Fire Protection and Safety program at Oklahoma State University. To learn more about RJA, visit their website at www.rjagroup.com.

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ANGUS FLIES EMERGENCY FOAM TO QUAKE-HIT JAPAN

Angus Fire has flown emergency stocks of fire fighting foam to Japan to help emergency crews deal with the aftermath of the recent earthquake.

The drama started on 26 September when a powerful earthquake measuring 8.3 on the Richter scale rocked the northern Japan island of Hokkaido. Subsequent aftershocks measured 5.0 or stronger on the Richter scale.

As a result of these tremors fire broke out in a bulk fuel storage tank at the Idemitsu Kosan Company oil refinery at Tomakomai in southern Hokkaido. Fire fighters on the scene were able to extinguish the fire in a few hours using fire fighting foam.

However, it soon became apparent that much larger stocks of foam would be required to prevent fuel that had become exposed to the air from catching fire by covering it with a vapour-suppressing foam blanket.

Fire officers decided to source the extra stocks from the Angus Fire foam production facility at Bentham, the largest of its kind in the world.

Angus Fire received the call for help in the middle of the night at 01.30 on 1 October. Within two and a half hours Angus Fire confirmed that 100 tonnes of foam concentrates including Tridol ATF and Alcoseal would be available for despatch that afternoon at nearby Manchester Airport.

However, finding a suitable cargo aircraft to transfer it to Japan proved more difficult since many had been pre-booked for humanitarian aid flights to Iraq. Angus Fire solved the problem by chartering a Boeing 747 "Jumbo Jet" cargo aircraft to be flown specially from New York into Manchester.

The aircraft was loaded throughout the day on 3 October and flew out to Sapporo Airport in Japan via Alaska that evening. SOS Air Cargo, Menzies World Cargo, Ringway Handling Services and Manchester Airport all helped Angus Fire with the transport logistics.

This latest incident further strengthens the track-record of success which Angus Fire has established in delivering urgently needed supplies of foam to major incident sites around the world.

Angus Fire is part of Kidde plc, the largest independent fire and safety equipment supplier in the world. Angus Fire's Managing Director Chris Milburn commented, "I'm delighted we were able to organise for our product to be flown to Japan so quickly. This has been a real team effort with many people and companies involved".

For further information, please contact:
Angus Fire
Fax: +44 1844 265 156
Website: www.angusfire.co.uk

FSI PORTABLE HAZMAT DECON SHELTERS & SHOWER SYSTEMS

FSI proudly offers the DATTM 2020S one person ambulatory, portable hazmat decon shower system unit built to the same demanding specifications as the entire line of FSI Shelters recognized by their EMS Blue Colour and available in multiple sizes, with an integral ground floor that will hold up to 100 gallons of water before requiring pump out, 2 roll up windows, skylight, full closure slip in and out dirty entry/clean exit doors, air inflation valve and hose, pressure relief valve, Pegs/Rods/Bag/Tie Downs, Repair kit, manual, carry bag, 2 upper air vents.

The DATTM 2020S offers six shower heads and a single 50' length of coiled ½" hose with an attached multiple function spray gun with spray patterns and flows meant to gently yet thoroughly drench and decon victims.

Simply inflate the unit and plug into a water supply and commence decontamination in less than 1 minute.

FSI proudly also offers the DATTM 3030S Two line, Mass casualty, portable hazmat decon shower system unit built to the same demanding specifications as the entire line of FSI Shelters recognized by their EMS Blue Colour and available in multiple sizes, with an integral ground floor that will hold up to 200 gallons of water before requiring pump out, 2 roll up windows, 2 skylights, full closure slip in and out dirty entry/clean exit doors, air inflation valve and hose, pressure relief valve, Pegs/Rods/Bag/Tie Downs, Repair kit, manual, carry bag, 2 upper air vents.

The DATTM 3030S offers 12 shower heads and a four 50' lengths of coiled ½" hose with attached multiple function spray guns with shut offs and quick disconnects offering spray patterns and flows meant to gently yet thoroughly drench and decon victims.

The DATTM 3030S is designed to handle two non-ambulatory, 4 ambulatory, or two ambulatory and one non-ambulatory victim at a given moment with privacy and change out areas possible.

Simply inflate the unit and plug into a water supply and commence decontamination in less than 2 minutes.

For more information, please contact:
FSI North America
A Division of Fire Safety International
Fax: +1 440 891 1562
Website: www.fsinorth.com

TAKING PERFORMANCE AND COMFORT TO A NEW LEVEL: THE NEW HILTI WSR 900-PE RECIPROCATING SAW MAKES CUTTING SWEET

The first in a growing line of cutting tools for the professional user, **Hilti** announces the release of its newest innovation – the WSR 900-PE Reciprocating Saw.

Performance Depends on a Smart Tool

Satisfying the need for performance, durability and handling, the Hilti WSR 900-PE Reciprocating Saw incorporates a "smart" power system. The Smart Power System combines efficient gearing and a load management sensor to continually monitor blade speed when under load. This means no more stalling while in the middle of a cut. And regardless of the base material – from metal to PVC – the WSR 900-PE yields up to 20 percent less vibration, allowing operators to make smooth, even cuts with reduced fatigue.

Smart Design Means Increased Productivity

Through extensive field-testing and observational research, Hilti found that users consider the ability to comfortably work in awkward cutting positions a top priority – a feature seriously lacking in the current reciprocating saw market. Using customer feedback, Hilti developed a large D handle with a multifunctional grip which allows the user to change their hand position easily to maximize cutting efficiency.

With its six-speed stroke rate regulator for optimising cutting in different base materials and the vertical motor mount that evenly distributes the tool's weight (7.1 pounds), the WSR 900-PE makes cutting jobs easier than ever before.

Used for almost any application involving cutting, general contractors, electricians, plumbers, steel fabricators and facility maintenance professionals will find working with a smart tool like the WSR 900-PE can help increase their efficiency.

Safety Features Offer Added Protection

The WSR 900-PE comes standard with an interlock switch, which minimizes the risk of unintentional engagement. Additionally, the 15-foot power cord is recessed to reduce accidental cord cutting for increased worker safety.

Two Models to Choose From

The WSR 900 is available in two models – WSR 900 and WSR 900-PE – to suit various needs. Both models feature a six-speed adjustment control for optimal stroke speed (0-2700 SPM) and a seven-position shoe that features an open face design for better visibility of cutting lines and improved accuracy.

Hilti stands behind the WSR 900 and WSR 900-PE with a One Year Full Service Program, which includes shipping, maintenance service, repair and replacement of all worn or defective parts, functional testing and adjustment and safety check after any repair.

For more information, please contact:
Hilti, Inc.
Fax: +1 918 252 6742
Website: www.us.hilti.com

FIRE ALARM TEST EQUIPMENT

HSI Fire & Safety Group, a new division of Home Safeguard Industries, is the world's leading manufacturer of fire alarm test and maintenance equipment. It's new line of *VersaTools™* includes the *VersaTest™* aerosol dispenser for functional testing of smoke and CO detectors *and* the *VersaPole™* telescoping fiberglass test pole with 20' extendable reach. Optional 4' extensions are available. HSI Fire & Safety Group has also recently expanded its original Smoke Detector Tester™ aerosol offering with its new 4.87 oz size. Both aerosols are UL listed, alarm manufacturer approved and meet NFPA 72 and international fire code test requirements. Put *VersaTools™* to the test today! Visit us @ www.detectortestequipment.com

For more information, please contact:
HSI Fire & Safety Group
Tel: +1 847 281 8400
Website: www.detectortestequipment.com

UK COMPANY WINS DECON ORDER FOR RUGBY WORLD CUP

Decontamination technology specialists, Milton Keynes, UK based **Professional Protection Systems**, landed a six figure contract to supply decontamination shower units as part of the security operation that will surround the Rugby World Cup games that will be played in New South Wales.

According to PPS Sales Manager Dave Watson, the order was obtained whilst Watson with PPS Managing Director, Mark Whitcher were on an Australian sales tour demonstrating the company's products recently. "It seems it was something they had left to last" says Watson, "so we had to do some pretty fast negotiating to make sure that everything was there by the first game this Friday (Oct 10) when Australia play Argentina."

By pulling out all the stops PPS have supplied New South Wales emergency services, who are responsible for terrorist response, with four of their large metal framed decontamination units that can handle 250 casualties and hour and one smaller inflatable unit. The large units can be up and running at the scene of an incident in 12 minutes, the smaller units in three.

To demonstrate the large units to the New South Wales Disaster Management team required a large area, difficult when you are in a couple of hotel rooms, but the ever resourceful duo, managed to hire an empty hotel swimming pool for what turned out to be a highly successful demo.

An enormous amount of interest was shown in the PPS range by different Australian companies and organisations, not just in the decontamination equipment but in the company's range of protective clothing as well. "Our research showed that Australia was a great potential market but we never expected to get a six figure order this quickly" commented Whitcher. This Australian order now means that PPS is selling its equipment in every continent.

For more information please contact:
PPS
Tel: +44 1908 583741
E-mail: sales@ppsgb.com

VERY EASY TO HANDLE: 2 LOOP FIRE ALARM CONTROL PANEL FROM SECURITON

SecuriPro® Compact, the new fire detection system of **Securiton** is suitable, above all, for small and midsized objects. In view of its special functionalities, this compact system is also able to fulfil complex demands. SecuriPro® Compact has a limit of two detector loops, using the SecuriLine® communication protocol. The two loops can run up to 254 participants – detectors and modules can be connected. Of course the complete SecuriStar® fire detector range can be connected to SecuriPro® Compact, namely the new combined smoke and heat detector STD 531 as well as the proven scattered light smoke detector SSD 531 and universal temperature detector UTD 531. That includes all special fire detectors like aspiration smoke detector ASD 516, linear heat detector ADW 511 or explosion proof detector Ex-i. Apart from the hardware, a new configuration software is available: SecuriWin Easy. This software stands out for commissioning the main control unit with a normal PC in a Windows environment without any special tools, and enables the installer to work with his usual PC. The program is set up in a way that all possible system components of the compact system are listed and can be chosen in the screen-work-sheets according to the actual system layout. Within these screen-work-sheets, only the assignment and the function have to be chosen and confirmed. SecuriPro· Compact requires minimal investment in training, system design and commissioning, which results in a very fast and cost effective handling by the technical staff.

For more information, please contact:
Securiton AG
E-mail: export@securiton.ch
Website: www.securiton.ch

NEW SUPPRESSION SYSTEM FIGHTS FIRES WHERE THEY START

A reliable yet low cost automatic fire detection and suppression system designed for confined spaces that fights fires where they start is the latest innovation from **Wormald**.

Designed to protect small electrical and electronic equipment, flammable liquid and mechanical equipment enclosures such as hydraulic pump and valve cabinets and internal combustion engine housing, FireTrace® is easily installed and is SSL Activfire listed.

The FireTrace® tube is made of a hard but flexible extruded thermoplastic material that weakens rapidly when heated, allowing the carbon dioxide gas under pressure within to quickly expand and burst the tube wall. The hole created in the tube wall is quite large in relation to the tube diameter and is naturally orientated toward the heat source, which created it, directing a strong jet of carbon dioxide toward the fire or heat source. Once the tube bursts enough carbon dioxide to flood the whole enclosure is delivered through the hole in the FireTrace® tube, extinguishing the fire in seconds.

Because it is self-activating, and does not require electrical or other external power sources and because it eliminates expensive piping and nozzle installation- Fire Trace is highly cost effective.

The FireTrace® Modular Carbon Dioxide Fire Detecting and Extinguishing System is designed to comply with the requirements of AS 4214 but it is only with proper installation, testing and regular maintenance that correct operation is ensured when a fire emergency occurs.

The eight companies involved in the re-branding include; Mercury Engineering, Metropolitan Fire Systems, Simplex, Tyco Fire Equipment, National Fire & Security, Automatic Fire Services, Tyco Emergency Evacuation Procedures and Fire Control (service division only).

For more information, please contact:
Tyco Services Fire & Safety
Tel: 061 2 9497 7928
E-mail: nickiwalsh@tycoint.com

ZUMRO RESQ 65 SPREADER: PERFECT BALANCE

Zumro ResQ, the Netherlands, continuously improves its line of hydraulic rescue tools in order to be able to rescue the victims in a safe way, even from the latest types of trucks.

Already being tested on a variety of new trucks, such as DAF and Volvo, the ResQ 65 spreader proves to be a very compact rescue tool and it has an excellent power to weight capacity. The ResQ 65 has a spreading capacity up to 28 tonnes at the base of the jaws.

The ResQ 65 spreader is also equipped with the unique, *truly flat face connectors'*. These flat face connectors allow you to blindly connect the couplings without any hazard of getting sand or dirt into the connectors while connecting them to the rescue tools. Any possible sand or dirt can simply be removed by wiping it away by the hand.

In order to develop the best rescue solution, Zumro ResQ constantly listens to its customers. Due to this interaction Zumro stays ahead in the latest updates that are necessary to create the most reliable tools for the rescue services all over the world.

For more information please contact:
Zumro BV
E-mail: info@zumro.nl
Website: www.zumroresq.com

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APF IS PUBLISHED 4 TIMES A YEAR – MARCH, JUNE, SEPTEMBER AND DECEMBER

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